FEB 19 1924

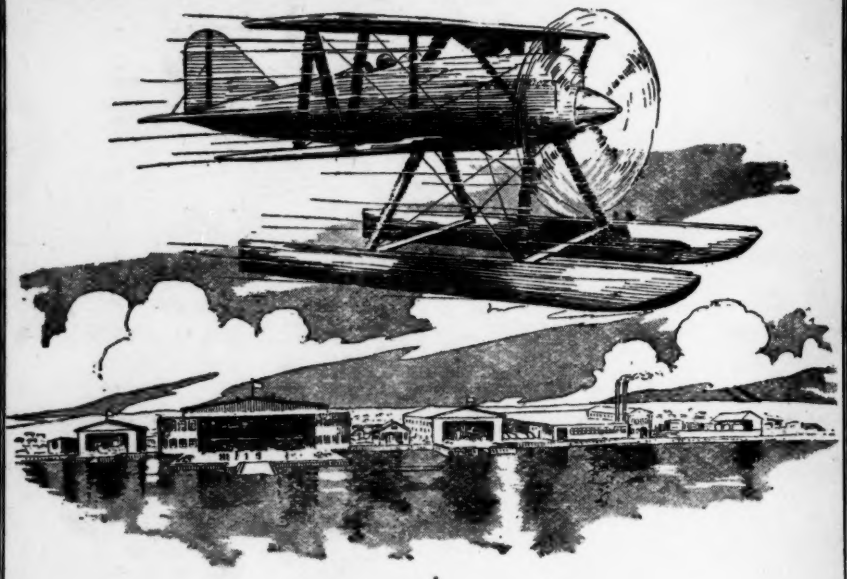
United States Naval Institute Proceedings

VOL. 50 FEBRUARY, 1924 NO. 252

CONTENTS

Rigid Airships—United States Ship "Shenandoah."—Bartlett . 161
Beginnings of the United States Naval Academy.—Paullin . . 173
Elementary Points of the Treaty Limiting Armaments.—Doyle . 195
America's Part in Founding the German Navy.—Goodrich . . 208
Report on the Fitness of Officers.—Richardson 214
The Horizontal Angle Method of Finding the Local Sidereal Time.—Kellar 219
Selling to the Service.—Adee 234
Smoke Screen Athletics.—Aamold 237
A Suggestion for Improving the Present Test on Boiler Water.—Dow 244
Discussion 248
Professional Notes 265
Notes on International Affairs 325
Review of Books 333
Secretary's Notes 336

Copyright 1924, by U. S. Naval Institute



How Rubber Serves the Navy— for Seaplanes and Dirigibles

Rubber has played its part in achieving for United States naval planes the supremacy of the world, so clearly shown in the Schneider Cup Races.

The Naval Air Service has attested the value of "U. S." Peerless Gasoline Hose, Official 666, for example, by the quantities it has now in use.

Other U. S. Rubber Company products useful for the same branch of the service are "U. S." Aircraft Radiator and Water Hose, "U. S." Giant Metal Lined Gasoline Filling Hose, "U. S." Crashproof and Leakproof Rubber Covers for airplane gasoline tanks, "U. S." Paravar Rubber Varnish, Pilot Balloons, Balloon Fabrics, Rubber Handgrips, Pedal Rubbers, Grommets and Gaskets and Packings.

UNITED STATES RUBBER COMPANY AND ASSOCIATED COMPANIES — US — RUBBER SYSTEM

Trade Mark

United States Rubber Company

1790 Broadway **New York**

United States Naval Institute Proceedings

February, 1924

Edited by H. G. S. Wallace

U. S. Naval Institute

Publication Office: Menasha, Wisconsin
Editorial and Business Office: Annapolis, Maryland

COPYRIGHT, 1924
BY
U. S. NAVAL INSTITUTE

The Collegiate Press
GEORGE BANTA PUBLISHING CO.
MENASHA, WIS.

THE U. S. S. "SHENANDOAH" AT THE MOORING MAST

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

VOL. NO. 50, NO. 2 FEBRUARY, 1924 WHOLE NO. 252

THE U. S. S. "SHENANDOAH" AT THE MOORING MAST

RIGID AIRSHIPS—UNITED STATES SHIP "SHENANDOAH"

BY LIEUTENANT COMMANDER H. T. BARTLETT, U. S. NAVY

THE rigid airship differs from the other types of lighter-than-air ship by having a rigid metal framework enclosing the lifting elements, so that the gas pressure is not relied upon to retain the form of the ship, either entirely as in the non-rigid type, or in part as in the semi-rigid type.

The first rigid airship was built by Count Zeppelin in 1900. In 1913 the Zeppelin Company had three commercial ships which operated successfully from Berlin as a base. When war was declared in 1914, the Zeppelin Company proceeded to build larger ships for the use of the German Navy, and by the close of the war had built about 143 ships. Since the Armistice, German development and operation have been so restricted by the Treaty of Versailles that nothing has been done except the construction and operation of the *Bodensee,* and the construction of the *Nordstern,* a passenger ship, and of the *ZR-3* for the United States Navy.

In 1917, the British, appreciating the value of rigid airships as fleet scouts, commenced building such ships, which construction culminated in the crossing of the Atlantic by the *R-34* in the summer of 1919. Soon after this a wave of economy caused the British to close all airship stations and scatter the personnel.

The Italians had the misfortune to wreck both of the rigid airships which they obtained from Germany after the Armis-

tice, and the French did not do much with theirs until last year.*

In this country, however, there were a few individuals who kept the art alive, and continued study and research. Past experience was analyzed, and four facts became apparent: first, that the German naval experience was, on the whole, highly successful; second, that the exclusive development of helium gas production in the United States was of fundamental advantage to us; third, that such a disaster as the *R-38* wreck in England was preventable by care in design and testing; and, fourth, that Major Scott's invention of the mooring mast would eliminate many difficulties in handling, and greatly increase the operating value of airships. The Navy Department, therefore, through the Bureau of Aeronautics, after a careful estimate of the situation, enlarged its program of research and decided to push the design and construction of the *Shenandoah,* our first rigid airship. The great shed at Lakehurst was completed with docking rails on the German system, while a mooring mast of Scott's type was constructed for use in bad weather.

The design of the *Shenandoah* was based on a very complete survey and analysis of German successful practice so far as information was available, checked by comparison with unsuccessful practice when data were available, and finally checked on an exhaustive theoretical investigation, involving original work in the theory of indeterminate structures, aerodynamics and naval architecture. Eventually, the design, so far as structural strength was concerned, was submitted for review to a special committee of engineers appointed by the National Advisory Committee for Aeronautics, and was approved by this committee.

The hull structure of the *Shenandoah* consists essentially of a framework of duralumin girders running transversely and longitudinally, with high tensile steel wires acting as diagonal braces in the quadrilateral panels formed by the girders. The rings formed by the transverse girders are sixteen and four-tenths feet apart, and the alternate rings are cross-wired with about eighty steel wires in each ring, giving transverse rigidity to the hull, and dividing it into twenty compartments, each of which contains a cell made of cotton cloth lined with goldbeater's skin, and in-

*Editor's Note—This airship, the *Dixmude,* was recently lost during a severe storm over the Mediterranean.

U. S. S. "SHENANDOAH" IN FRONT OF HANGAR AT LAKEHURST, N. J.

flated with helium gas. The displacement when completely inflated is about the same as the water displacement of the *Leviathan*.

Along the bottom of the interior of the hull there is a corridor or keel of triangular section, apex upwards, about ten feet high by twelve feet wide at the midship section, and tapering somewhat toward the bow and stern. Along the center of this corridor is a narrow walkway, and on either side are the gasoline tanks and ballast bags suspended from a pair of longitudinal girders. Hammocks for the crew are also suspended from these girders.

Directional control, horizontally and vertically, is secured by four fins and rudders near the stern. At a little distance, the fins appear to be thin flat surfaces, but they are really triangular in cross section, and of such ample dimensions that the longitudinal walkway is carried in the lower fin.

The metal framework of the hull, fins and rudders is covered with cotton cloth, drawn tight to give a smooth exterior along which the air flows with the least possible friction. The proper tension in the outer cover is obtained by shrinking it with "dope" after it is laced to the girders. The silvery appearance of the airship is due to aluminum powder in the "dope" to provide a surface which reflects the sun's rays as much as possible. The passage of sunlight to the interior of the ship is further prevented by black pigment on the inner surface of the cover. These precautions against the sun are taken to avoid an undesirable superheating of the gas, and to protect the gas cells against the deteriorating effect of sunlight.

The propelling plant consists of six Packard engines of special design, each with six cylinders in line, and capable of developing 300 horsepower, but ordinarily operated at less than half power. The engines are contained in separate cars distributed along the under side of the hull. Four of the engines drive geared-down propellers, and two have direct drive. Two of the geared propellers may be reversed through gears to assist in checking the headway when landing the ship.

The control car is incorporated with the forward power car. There is room in it for six to eight men, and it may well be compared to the bridge and chart room of a surface ship. Besides the wheels for operating the vertical and horizontal rud-

ders, the controls for the gas valves and ballast bags, engine room telegraphs and the navigational instruments are here. At the rear of the control car there is a sound-proof radio compartment, equipped with powerful radio telephone and telegraph apparatus.

The metal of which the girders are constructed is an aluminum alloy known as duralumin, invented by a German named Wilm about twenty years ago. It contains about four per cent copper, five-tenths per cent magnesium and four-tenths per cent manganese. When properly heat treated it has the strength of mild steel, with only about one-third the weight. The manufacture of this material in America has been successfully accomplished by the Aluminum Company of America and the Baush Machine Tool Company, which are licensed by the Chemical Foundation under patents purchased from the Alien Property Custodian during the war. Credit is also due to the Bureau of Standards and the Naval Aircraft Factory in the development of the technique of the manufacture and heat treatment of duralumin.

Most of the girders are triangular in section, and are composed of longitudinal channels along the three corners, braced together by crossed latticés formed of light, corrugated stampings, riveted to the channels, and to each other where they cross. A typical longitudinal girder is sixteen and four-tenths feet long between transverse frames, weighs only ten pounds, and is capable of sustaining a column load of 5,000 pounds, or a uniformly distributed transverse load of 2,000 pounds, without allowing for the extra strength given by the rigidity of the connections to the transverse frames.

The gas cells are of single ply cotton cloth made gas tight by goldbeater skins secured to the cloth by a rubber solution adhesive. The skins are obtained from the intestines of oxen, and nearly three-quarters of a million oxen contributed to the vast number of skins required on the *Shenandoah*. The manufacture of these gas cells was also an entirely new art in America, and was successfully accomplished by the Goodyear Tire and Rubber Company, following methods developed principally in England.

The design of the *Shenandoah* was based mainly on a German airship, the *L-49*, brought down intact in France in the autumn of 1917. Detailed drawings of the *L-49* were made by the French

Government, and forwarded to the United States Navy in 1918. The *Shenandoah* has one more cell, thirty-two and eight-tenths feet long, in the parallel middle body, than her German prototype, and the weight and strength of the framing are somewhat increased—especially near the bow, to provide for the airship lying to a mooring mast, an operating feature never practiced by the Germans. The power plant was also increased from five engines, of 240 horsepower each, to six of 300 horsepower each, although, as stated, these are supposed to run at about 200 horsepower. These changes and the use of helium have involved considerable loss of load capacity, and altitude attainable.

In spite of the reduced lift compared with the German airships, the *Shenandoah* can carry sufficient gasoline to maintain her normal speed of about sixty miles per hour fifty hours, or a cruising speed of forty miles per hour for 140 hours without refueling.

The girders and power cars were constructed by the Naval Aircraft Factory, Philadelphia, Pa., and the ship was assembled in the giant shed of the Naval Air Station, Lakehurst, N. J.

The general characteristics of the ship are as follows:

Length—680 feet.
Diameter—78.7 feet.
Height—96 feet.
Gas capacity—2,150,000 cubic feet.
Total lift (helium) about 130,000 pounds—(hydrogen) about 136,000 pounds.
Dead weight—about 74,000 pounds.
Speed—about sixty miles per hour.
Horsepower—six 200-300 H.P. engines, total 1,200-1,800 H.P.
Cruising radius without stopping—over 4,000 miles.
Crew—nine officers, twenty-two enlisted men.

The *Shenandoah* is filled with helium, which is one of the reasons we hope for success from our Navy rigids. Helium is found in certain of the natural gases occurring in a belt which extends from Texas north-eastward through Oklahoma, Kansas and Nebraska. It is one of the rare gases, and was discovered in the sun by means of the spectroscope in 1868, twenty-seven years before Sir William Ramsay discovered it on our globe. Up to 1917 there had not been produced more than two and eight-tenths cubic meters. Next to hydrogen, helium is the

lightest known substance. Although it is about twice as heavy as hydrogen, it can impart to a balloon an ascensional force equal to ninety-two and six-tenths per cent of the force hydrogen would give it. This seems to be a paradox, but the explanation is very simple. The ascensional force of a gas is not measured directly by considering its specific weight, but by finding the difference between the weight of a certain volume of the gas and the weight of the same volume of air. Hydrogen and helium are both so light in comparison with air, that the difference between their respective ascensional forces becomes insignificant, when employed in balloons. If we consider, for example, a volume of twenty-eight cu. m. (1,000 cu. ft.) of hydrogen, it will be able to lift a weight of 34.038 kilograms (75 lb.), while a like volume of helium will lift 31.52 kilograms (70 lb.).

The helium project is a joint project of the Army and Navy, assisted by the Bureau of Mines. The helium plant is located at Fort Worth, Tex. The gas is supplied from the Petrolia wells, which are about 160 miles north of Fort Worth, and is piped into Fort Worth for domestic use. In the Linde process use is made of the Joule-Thompson principle, and the separation of the helium is based on the principle, and the fractional distillation of the gases by successive compression and expansion. The lowering of the temperature, by the expansion of the strongly compressed natural gas in passing through a small opening, is sufficient to cause the liquefaction of all the gases except helium, which is then quite readily separated from the others.

Helium has been found to be easier to retain in the gas cells than hydrogen, and the loss of helium by diffusion from the cells of the *Shenandoah* has been astonishingly small. Even though the helium does become contaminated by incoming air it is possible to pump out the impure helium and repurify it very much as was done with the original natural gas and thus use the helium over and over again.

We must be very jealous of this gas, as its supply is evidently very limited, and once it has escaped into the atmosphere it is gone forever. Consequently methods of conservation of the supply in the ground have been proposed, and are partially in progress.

We must also conserve the gas in the operation of the ship.

U. S. S. "Shenandoah" and Navy "F-5 L" over Potomac River at Washington, D. C.

This is rather difficult, because so far we have been accustomed to operating with hydrogen, which was comparatively inexpensive, and have not worried about its conservation.

When an airship rises the gas in the cells expands, and if the rise is great enough, the cell will be completely filled, and must relieved through safety valves. This gas discharge through safety valves is the normal way to keep the ship in equilibrium, or as nearly so as possible, so that it will not tend to rise or fall by an amount greater than can be counteracted by the use of the rudders. The burning out of the fuel tends to make the ship continually light, and there soon comes a time when it is impossible to avoid the loss of gas.

However, it has been happily discovered that, for every pound of gasoline burned in the engines, there is produced about one and one-third pounds of water vapor in the exhaust. If we could condense all of this water vapor as it was formed, we would actually increase the weight of the ship steadily as the fuel burned out. As this complete condensation would require very elaborate apparatus, we are content if we can get back just as much weight in water as we have burned out in gasoline. Apparatus for accomplishing this has already been developed. The Navy began the solution of this problem some five years ago, and actually succeeded in obtaining the desired rate of condensation. The apparatus, however, was much too heavy to be practical. In the meantime, the project had attracted the attention of the army engineers, and, with the assistance of the Bureau of Standards, they continued the work begun by the Navy Department, finally producing a very successful piece of apparatus with a weight which was practical for use on airships. In line with the spirit of co-operation which exists between the two services, complete information as to the apparatus and its results was given to the Navy Department, and we are now engaged in the modification and redesign of this apparatus to suit the *Shenandoah*. Before the beginning of next spring, it is expected that all of the engines on the ship will be equipped with water recovery apparatus, and from that time the loss of helium will be almost negligible.

The first airship to be inflated with helium was the U. S. Navy non-rigid *C-7*, which made a flight, while so inflated, from

U. S. S. "SHENANDOAH" AND NAVY "F-5 L" OVER POTOMAC RIVER AT WASHINGTON, D. C.

Hampton Roads to Washington and return in December, 1922. The second and only other ship to be filled with helium is the *Shenandoah.*

Mooring masts will be erected at different points so that airships can tie up to them and refuel with gasoline and oil, re-gas with helium (or hydrogen), take on other stores, ammunition, personnel, etc. They can also effect repairs while at a mast. In other words, if there is a mast at Panama the *Shenandoah* could fly down there, maneuver with the fleet, go to the mast, refuel, and continue her operations indefinitely. The *R-33,* the British rigid, lay at her mooring mast for five months, just as a ship will lie at a buoy.

The Bureau of Aeronautics has designed a mooring mast to be placed on board a ship. Such a mooring mast ship, equipped with helium and gasoline stowage, will greatly increase the value of rigid airships to the fleet by furnishing a mobile airship base with the fleet. It is perfectly practicable for an airship to stay at such a mast indefinitely, and they have also been successfully towed by vessels at sea. Such a ship will also be another step in carrying out the Navy Department's policy of directing the main efforts of Naval Aviation toward aircraft with the fleet.

The mooring mast is a structural steel tower approximately 165 feet in height. At the extreme top of the mast is a revolving cup into which a cone on the bow of the ship is secured, and the ship thereby moored. The ship can swing to the wind, through an arc of 360 degrees, thus always heading into the wind.

Running up through the center of the mast are gasoline and oil lines for refueling, a water main for taking on water ballast, and a large main for helium or hydrogen. The mast at Lakehurst is also equipped with an elevator, by which personnel and material can be transferred, and food and other stores furnished, to the ship.

For normal flying the *Shenandoah* carries about four tons of water ballast, which can be let out when it is desired to lighten the ship for maneuvering.

The Navy is developing the rigid airship on the recommendation of the General Board, which policy has been approved by the Secretary of the Navy.

These ships are primarily for use as long distance and long endurance fleet scouts. The radius of the *Shenandoah* is over 4,000 miles. If a mooring mast has been put up, or some other means provided for refueling and re-gassing, she can go 4,000 miles more and keep this up indefinitely. As scouts, their radius of action, their ability to hover, their ability to climb quickly to great heights of over 20,000 feet, their ability to receive and transmit information, and protect submarines and other ships at long distances, make them indispensable to the Navy. Other uses are coastal patrol, long distance convoy work, anti-submarine operations, mine searching, bombing enemy fleets or bases, maintaining communications with detached expeditionary forces, providing supplies, and transferring personnel.

As helium cannot be ignited or exploded, and the ships are an excellent gun platform and are capable of carrying a large number of machine guns, one and two pounder automatics, and even three inch rifles, they are of considerable value as fighting units.

The following quotation is made from Admiral Jellicoe's "Grand Fleet," London, 1912, and certainly shows their value to the Germans at Jutland. Had they been more enterprising, they could have dropped tons of bombs on the Grand Fleet during the fleet action.

"From 8:24 A. M. onward, Zeppelins were frequently in sight from both the Battle Fleet and the Battle Cruiser Fleet, and were fired at, but they kept at too long a range for our fires to be effective. The *Galatea* sighted the first Airship at 8:24 A. M., and the second was seen by the Battle Fleet at 9:55 A. M.; at 10:00 A. M. the *Harwich* force reported being followed by a Zeppelin. This force was shadowed by airships during the whole period of daylight on the nineteenth. The trawler *Ramexo* had two Zeppelins in sight. It was evident that a very large force of airships was out. A total of at least ten were identified by our directional wireless stations, and they appeared to stretch right across the North Sea."

Von Scheer also testifies in his official report to the valuable information received from Zeppelins at Jutland. It is obvious from a study of the battle that the Grand Fleet was playing a game of blind man's buff, never certain of the position or composition of the enemy, and moreover, they ran a serious risk

from submarines and mine fields whose positions they would have known if they had had aircraft. The German Fleet, due to their airships, followed the Grand Fleet's movements throughout the day, and engaged when and where they wished, with a full knowledge of the enemy's units.

Commercially rigid airships can carry a cargo of twenty-five tons 5,000 miles over land or water, or both, at a speed of over seventy miles an hour. They can navigate in all sorts of weather, and, if necessary, circumnavigate storms, even climbing over them, or hover and wait for fog to lift. It is undoubtedly possible to construct, at the present time, rigid airships having speeds of ninety miles an hour, and a cruising radius of 10,000 miles without refueling. Such ships would make the New York-London trip in thirty-four hours; the New York-San Francisco trip in thirty-one hours; the San Francisco-Honolulu trip in twenty-six hours; the Honolulu-Manila trip in forty-seven hours; the New York-Panama trip in twenty hours, and the New York-Buenos Aires trip in fifty hours.

The Navy, therefore, in keeping with its usual habit of interesting itself in the development of new and important scientific and mechanical inventions, expects to prove the great value of the rigid airship, both as a commercial carrier, and as an important aid to the defense of this country in time of war.

BEGINNINGS OF THE UNITED STATES NAVAL ACADEMY

By Charles O. Paullin

Editor's Note: This article gives a history of early education in the Navy, and of efforts made from 1777-1845 to establish a proper naval school. It carries through to the establishment of a school in the Naval Asylum at Philadelphia, and to its removal to Annapolis, where, in 1845 by order of George Bancroft then Secretary of the Navy, the present Naval Academy was founded.

PROBABLY no other national institution has been so largely created by the executive branch of the government as the United States Naval Academy. Not until the Civil War did Congress manifest any particular interest in naval education, and not until the Spanish-American War did it appropriate money liberally for that purpose. The people were even more indifferent than Congress. On the other hand, from the founding of the Navy in 1794 to the establishment at Annapolis of the Naval School in 1845, the most progressive Presidents, every Secretary of the Navy (with possibly one or two exceptions), and many naval officers advocated the extension and improvement of the educational facilities of the Navy. Under these circumstances, the early efforts in behalf of naval education took one of two forms: (1) movements to obtain legislation in behalf of a naval academy, and (2) administrative measures of the Navy Department establishing and encouraging naval schools. All early attempts to move Congress to pass a law instituting a naval academy failed. Some of these fruitless efforts will be first considered.

One of the first, if not the first, recommendations for the establishment of a school or schools for the instruction of the officers of the American Navy was made by Captain John Paul Jones early in the American Revolution. It is to be found in his "Plan for the Regulation and Equipment of the Navy," which was drawn up at the request of the President of the

Continental Congress, and which was dated Philadelphia, April 7, 1777. Jones proposed to establish an "Academy" at each of three dockyards, "under proper masters, whose duty it should be to Instruct the Officers of the Fleet when in Port in the Principles and Applications of the Mathematicks, Drawing, Fencing and other manly Arts and Accomplishments." He further proposed to test the abilities of the young men who applied for commissions in the Navy by an appropriate examination. He would also have them serve a certain term in "Quality of Midshipmen, or Masters mate" before they were examined for promotion.[1]

The earliest plans for a naval school that were formulated after the adoption of the Constitution provided for such an institution in connection with a school of the Army. In June, 1798, Alexander Hamilton, Inspector-General of the Army, in view of the disturbed relations then existing between the United States and France, recommended several measures for placing the country in a state of defense. One of these was the establishment of an "academy for military and naval instruction." In November, 1799, he sent to Secretary of War McHenry an elaborate plan for a military academy, which provided for five schools: a fundamental school, a school of engineers and artillerists, a school of cavalry, a school of infantry, and a school of the Navy. Young men preparing for the naval service were to spend two years in the fundamental school studying the general branches of knowledge, before entering the school of the Navy, after which they were to receive instruction for two years in spherics, astronomy, navigation "with the doctrines of the tides," and naval architecture. "To admit of exemplifications of naval construction and exercises," Hamilton proposed to locate his school on navigable waters. In a very general way, the present course of instruction at the Naval Academy follows Hamilton's plan.[2]

In a report on a military academy, which McHenry made to President John Adams in January, 1800, Hamilton's plan, slight-

[1] C. H. Lincoln, Calendar of John Paul Jones Manuscripts in the Library of Congress, p. 20.

[2] J. C. Hamilton, Works of Alexander Hamilton, VI, 295; H. C. Lodge, Works of Alexander Hamilton, VI, 265-272.

ly changed, again appears. McHenry proposed to send the naval officers on practice cruises, in which they were to be "exercised in the manoeuvers and observations most useful in service, and be instructed in whatever respects rigging of vessels of war, pilotage, and the management of cannon." When McHenry's successor as secretary of war, Samuel Dexter, proposed to establish a school for artillerists and engineers, President Adams and Secretary of the Navy Stoddert agreed that it would be highly useful to the Navy, and that midshipmen ought to be admitted to the school. On the establishment of the Military Academy in 1802, notwithstanding this recommendation, no provision was made for the instruction of naval officers. The notion of a joint school for the Army and the Navy was not, however, at once abandoned. In 1808, President Jefferson, who wished to centralize federal administration at the capital under the watchful eye of the government, favored the removal of the Military Academy at West Point to Washington and the extension of its benefits to the naval service.[3]

Previous to the War of 1812, it was by no means clear to Jefferson and the Democrats that a Navy was an essential institution to a peace-loving democracy. During the war, however, the Navy won its way into popular favor by its gallant exploits, and its permanency was for the first time assured. By the end of the war, the spirit of nationalism was at high tide, the Navy had reached its maximum size, and the need of some means of instruction for the many young and unschooled midshipmen was strongly felt. Obviously, the time was ripe for a movement to establish a naval academy separate and distinct from the Army school.

On November 15, 1814, Secretary of the Navy William Jones took occasion in a communication to the Senate on the reorganization of the Navy Department to "respectfully suggest the expediency of providing by law for the establishment of a naval academy, with suitable professors, for the instruction of the officers of the navy in those branches of the mathematics and experimental philosophy, and in the science and practice of gunnery, theory of naval architecture, and art of mechanical drawing,

[3] Am. State Papers, Mil. Aff., I, 133-134, 228; Works of John Adams, IX, 65.

which are necessary to the accomplishment of the naval officer. The project was favored by some of the leading naval men. Captains Samuel Evans and Thomas Tingey said that a naval academy would be beneficial to the service. On the other hand, doubtless not a few officers agreed with Captain Charles Stewart that the "best school for the instruction of youth in the profession is the deck of a ship." [4] Early in 1815 the subject of establishing a naval school came up in both the House and Senate, but nothing was accomplished.

From 1814 to 1845 an agitation for a professional school of the Navy similar to the Army school at West Point was conducted in Congress, in the Navy Department, and in the Navy. During this period every Secretary of the Navy, with the possible exceptions of George E. Badger and Thomas W. Gilmer, whose terms of office were brief, recommended either to Congress or to the President the establishment of a naval school or schools. These secretaries were William Jones, B. W. Crowninshield, Smith Thompson, Samuel L. Southard, John Branch, Levi Woodbury, Mahlon Dickerson, James K. Paulding, Abel P. Upshur, John Y. Mason, and George Bancroft. It should also be said that the first three Secretaries of the Navy, Benjamin Stoddert, Robert Smith, and Paul Hamilton, were disposed to increase the meager educational facilities of the Navy, and that Hamilton suggested the sending of midshipmen on their entrance into the service to the naval hospitals for instruction in navigation and other sciences connected with their profession. For the thirty years preceding 1845, the correspondence between the Secretaries of the Navy and the naval committees of Congress on the establishment of a naval school was extensive. Various bills providing for one or more naval schools were drafted by the secretaries or other friends of naval education and introduced in Congress. Of these bills, two passed the Senate, but all of them failed in the House.

The most uncompromising opponents, as well as the most zealous advocates, of a naval school were to be found among the officers of the Navy. The opinion was by no means uncommon that book-learning and the theory of the naval and kindred sciences,

[4] Am. State Papers, Nav. Aff., I, 323, 356-359.

and even refinement and cultivation, were incompatible with the professional duties of a sea-officer. On the other hand, especially among the younger men of both the line and the staff, there was a growing demand that the government should improve professional equipment, elevate the character, and broaden the culture of the midshipmen. Among the lieutenants of the Navy, the most ardent advocates of a naval school were A. S. Mackenzie, L. M. Powell, M. F. Maury, and J. H. Ward. Mackenzie and Maury championed the cause of naval education in the periodicals of their day. Of the naval staff, Chaplain George Jones and Professors William Chauvenet and J. H. C. Coffin were the most active. Chaplain Jones drafted plans for a school and besieged the Navy Department and Congress to adopt them. In 1836 fifty-five of the junior officers of the *Constitution* and *Vandalia* petitioned the Secretary of the Navy and Congress to establish a naval academy.[5]

Various arguments were advanced by the friends of naval education. A professional school, they said, was as essential to the Navy as to the Army. Moreover, since the midshipmen entered the Navy at an early age and were assigned such duties on shipboard and in the navy-yards as precluded much advancement in learning, they needed to be grounded not only in professional studies, but also in the more general and more literary branches of education. The tone of the Navy needed to be elevated, its discipline improved, and the temper of its officers mollified. The inadequacy of the teaching of the schoolmasters at sea and in the navy-yard schools was pointed out. President John Quincy Adams, a typical New Englander in his encouragement of science, learning and morality, conceived that the midshipmen of the Navy might acquire practical seamanship at sea, "but a competent knowledge even of the art of shipbuilding, the higher mathematics, and astronomy; the literature which can place our officers on a level of polished education with the officers of other maritime nations; the knowledge of the laws, municipal and national, which, in their intercourse with foreign states and their governments, are continually called into operation; and, above

[5] J. R. Soley, Historical Sketch of the United States Naval Academy, 27-31.

all, that acquaintance with the principles of honor and justice, with the higher obligations of morals and of general laws, human and divine, which constitutes the great distinction between the warrior-patriot and the licensed robber and pirate—these can be systematically taught and eminently acquired only in a permanent school, stationed upon the shore and provided with the teachers, the instruments, and the books conversant with and adapted to the communication of the principles of these respective sciences to the youthful and inquiring mind." [6]

President Adams and his Secretary of the Navy, Samuel L. Southard, earnestly and continuously endeavored during their administrations to secure adequate provision for the education of naval officers. Southard again and again recommended the establishment of a naval school. As a site for it, he favored Governor's Island, New York, a most excellent location. The encouragement of naval education formed a part of President Adams' policy of nationalism and paternal government. In three of his four annual messages, he recommended the establishment of a naval school. Bills based upon the recommendations of Adams and Southard were in 1826 introduced in the two houses of Congress, but failed of passage. The House bill provided that the school should be located on any lands then held by the United States for naval or military purposes. It authorized the President to appoint from the captains of the Navy the "Commandant" of the school. The corps of instructors was to consist of a professor of natural and experimental philosophy and astronomy, a professor of mathematics and navigation, a teacher of geography and history, a teacher of the French and Spanish languages and a fencing master.[7]

The "Bill for the Gradual Improvement of the Navy," which passed the Senate on February 17, 1827, provided among other measures for a naval academy. Its provisions on this subject were similar to those of the House bill of the previous year, but they were less specific in their details and left more to the discretion of the President. The establishment of a naval academy was ably and eloquently advocated in the Senate by Robert Y.

[6] Richardson's Messages and Papers of the Presidents, II, 390.
[7] Register of Debates in Congress, II, 1055-1056.

Hayne, of South Carolina. General William Henry Harrison of Ohio, Ashur Robbins of Rhode Island, and William Smith of Maryland spoke in its behalf. Hayne's colleague in the Senate from South Carolina, William Smith, made the chief speech in opposition. After having stated that Julius Caesar, the Duke of Marlborough, the Maid of Orleans, Generals Brown, Miller, and Scott, and Colonel Towson were not educated in military academies, Smith proceeded to draw some conclusions respecting naval education from our experiences in the late naval war of 1812-15. "Where were Hull and Bainbridge raised?" he exclaimed. "Was it in an academy that they gained their knowledge of ships, their dauntless courage, and presence of mind, or the address which ensured their success? They were, if he did not mistake, engaged previous to the war in the merchants' service." Here, he said, was to be found the great school in which naval officers and seamen were to be instructed; and it was dangerous to close the Navy to those who were educated in it. In the House an amendment to strike out the clause relating to the naval academy was carried by a vote of 86 to 78. The Senate acceded to the amendment of the House by a vote of 22 to 21. By these narrow majorities this measure was defeated, and the establishment of a naval academy postponed for many years. The failure of the measures of 1826-27, as well as of many similar ones, may be ascribed to the disinclination of Congress to increase the expenditures and powers of the government, partisan opposition, and the lack of unanimity in the Navy respecting the establishment of a school. Moreover, at this time, many men honestly held that the naval profession was an art to be acquired at sea, and not a science to be learned in schools.[8]

With the advent of steamships, the Secretaries of the Navy discovered a new argument; for officers must now understand the laws of physics and the workings of marine engines. Secretary Upshur, in 1841, was the first to urge this consideration. Upshur showed considerable ignorance of the educational needs of the Navy, for he brought forward a plan providing for the estab-

[8] J. R. Soley, Historical Sketch of the United States Naval Academy, 21-22; Register of Debates in Congress, III, 348-376, 501, 506-524, 1365, 1500; Journals of the House of Representatives, March 1, 1827.

lishment of three or five naval schools, one each at Norfolk, Newport, and Boston, and possibly Pensacola and some convenient point on the Great Lakes. For purposes of discipline, government and instruction, he proposed to attach to each school a captain, a commander, two lieutenants, two passed midshipmen, two professors of mathematics, one teacher of foreign languages, a chaplain, a surgeon, an assistant surgeon, and two engineers. The students were to consist of both officers of the Navy and applicants for the position of midshipman. They were to be instructed in mathematics, navigation, and the French, Spanish, Italian and German languages. In July, 1842, a bill embodying in the main Upshur's plan was introduced in the Senate. It provided for the establishment of five schools at as many unoccupied fortifications of the Army, which were to be transferred from the War to the Navy Department. The bill was wisely amended by the Senate so as to provide for the establishment of but one school, and this one at or near Fortress Monroe, Virginia. It passed the Senate, but failed in the House. For the second time the latter body, reflecting the general views of the nation, showed itself less favorably disposed to the cause of naval education than the Senate.[9]

In December, 1842, January, 1844, and January, 1845, Senator R. H. Bayard, of Delaware, introduced bills in the Senate providing for the establishment of a naval school or schools. Bayard, who was chairman of the Senate Committee on Naval Affairs, manifested much interest in naval education. His bill of January, 1845, authorized the establishment of a naval school "under the direction of the Secretary of the Navy, on board of a vessel of the United States, in connection with Fort Norfolk, on Elizabeth River, in the State of Virginia, as a shore station." The curriculum of the proposed school provided for two courses of study, of eighteen months each. The preliminary course was to be pursued by candidates for admission into the Navy, and the advanced course by midshipmen after they had served three years at sea and as a preparation to an examination for promotion. Bayard estimated that

[9] Congress Letters, VIII, 349, 379, 452, 454; Congressional Globe, XI, 858-860, 864, 888, 961.

seven naval officers and ten teachers would be needed, and that the expense of the school would be considerably less than that of the existing corps of naval professors. The bill was reported favorably by the Senate Committee on Naval Affairs, and received the approval of Secretary of the Navy Mason. Congress, however, adjourned on March 3, 1845, without acting on it.[10]

From these futile efforts to obtain a naval school by legislation, let us turn to the work of the Navy Department, first in providing schools on naval vessels at sea and within or near the navy-yards, and later in establishing a naval school at Philadelphia.

In 1794, when the Navy under the Constitution was founded, the office of schoolmaster had for many years been established in the British Navy. The ancient schoolmaster was a warrant officer, who taught all the youths of his ship the rudimentary branches of a general and professional education. He was required to instruct the "Voluntiers in Writing, Arithmetick, and the Study of Navigation, and in whatsoever may contribute to render them Artists in that Science." Before admittance to the Navy, he had to pass an examination before the "Master, Wardens, and Assistants of the Trinity-House of Deptford-Strand"; and he must produce a certificate "under the Hands of Persons of known Credit, testifying the Sobriety of his Life and Conversation."[11]

Our first naval laws made no provision for a seagoing pedagogue, but this deficiency was early supplied by administrative authority. During our naval war with France, 1798-1801, schoolmasters were employed on board the smaller frigates and ships of war. Their pay and emoluments were fixed by President John Adams at thirty dollars a month and two rations a day. Adams wished to establish a school on board every frigate. On the first cruise of the ship *Boston* during the war with France, her school-

[10] Congressional Globe, XII, 84-85; XIII, 176; XIV, 128; Senate Docs., 28 Cong., 2 sess., no. 92.

[11] Regulations and Instructions relating to His Majesty's Service at Sea, quoted in Soley's Naval Academy, 9.

master taught thirty persons navigation and other naval sciences.[12] The chaplains at this time performed in addition to their other duties those of the schoolmaster. They were assigned to the larger ships, and the schoolmasters to the smaller.

On January 2, 1813, the office of schoolmaster was established by law.[13] An act of this date authorized the construction of four seventy-four-gun ships and provided that each of them should carry a schoolmaster, who was to be appointed by the captain and was to receive $25 a month and two rations a day. In 1816 additional ships of the line and additional schoolmasters were authorized. Under the rules of the department, the employment of schoolmasters on board the smaller vessels was continued. According to a rule in force in 1832, no vessel of the size of a sloop of war was to sail without a schoolmaster, "if one can be had." Usage permitted the captain to choose his naval pedagogue, but if he neglected this duty the appointment might be made by the department. The schoolmasters were appointed for a single cruise. With little pay, short tenure, and low official status, they were few in number and weak in pedagogical ability. Secretary Southard gave them the more dignified name of "professors of mathematics." In 1835 Congress adopted this name and placed the naval professor upon a more permanent footing by creating the naval Corps of Professors of Mathematics, and raising his pay to $1200 a year.[14] An appropriate entrance examination was now prescribed. As a result of these measures, the quality of the naval teachers was greatly improved, and within a few years several new men entered the new corps, whose abilities and achievements were of a high order. Among the most distinguished of the early professors were McClure, Chauvenet, Lockwood, Coffin, and Yarnall. The number of professors of mathematics in 1845 was twenty-two. In 1848 the number was fixed by law at twelve. The observers of the Naval Observatory have been largely recruited from this corps.

[12] General Letters, Navy Dept. Arch., III, 526; Works of John Adams, IX, 65.

[13] U. S. Statutes at Large, II, 789.

[14] Rules of Navy Department Regulating the Civil Administration of the Navy (1832), p. 38; U. S. Statutes at Large, IV, 756.

The chaplains often performed the duties of naval schoolmasters, and on at least one occasion an army officer acted in this capacity—Lieutenant C. G. Smith, of the Military Academy. Smith conducted a naval school on board the corvette *Cyane,* Captain J. D. Elliott, during a cruise on the coast of Brazil in 1826-27.[15] For many years a large part of the work of naval instruction fell to the chaplains. They made more efficient teachers than such schoolmasters as could be had for $25 or $30 a month, and it was in part for this reason that they were so often assigned pedagogical duties. The schoolmasters sometimes found their lowly station a stepping-stone to the more exalted and better paid position of naval chaplain. For instance, Rev. George Jones, one of the ablest chaplains of the Old Navy, entered the service as a schoolmaster. So closely were the two offices connected, that, on ships where no chaplain was employed, the schoolmaster was sometimes called upon to conduct religious exercises or to perform other duties of a minister of the gospel. Indeed, in selecting chaplains, the Navy Department at times looked to their pedagogical qualifications rather than to their excellence as divines. The regulations of the Navy, which specified the duties of the chaplain as teacher, were modeled in part upon the British regulations respecting schoolmasters. Those of the American Navy for 1802 assigned to the chaplain the duty of a schoolmaster. "To that end," in the quaint language of the regulations, "he shall instruct the midshipmen and volunteers in writing, arithmetic, navigation, and in whatsoever may contribute to render them proficient. He is likewise to teach the other youths of the ship, according to such orders as he shall receive from the captain. He is to be diligent in his office, and such as are idle must be represented to the captain, who shall take due notice thereof." [16]

The principal branches taught in the floating schools of the Navy were mathematics and navigation. Bowditch's practical, though superficial, treatise was the chief textbook for both subjects. Sometimes instruction was given in the rudiments of the French and Spanish languages. The hours of instruction were

[15] Russell Jarvis, Commodore Elliott, 232-233.
[16] Quoted in Soley's Naval Academy, 8-9.

usually from nine or ten o'clock in the morning until noon. The quarters assigned for a school were such as could be had. Occasionally the captain lent his forward cabin. More often the schoolroom was on deck, separated by a mere canvas partition from the manifold noises of four or five hundred seamen. On sloops of war it was situated in the dimly-lit steerage. The schoolroom on shipboard is described by Chaplain Walter Colton as a "sort of thoroughfare, and is a living echo of the incessant din of all that is doing upon deck. The builders of Babel with their countless hammers and unintelligible tongues scarcely sent up a clamor of more confused sounds than what descends from the deck of a man-of-war. There is no noisy trade from the sledge and anvil of the smith to the hammer and awl of the cobbler that is not here pursued with its customary disrespect of silence. Add to this the rush of surging sea that never sleeps and the frequent cloud speaking in tempest and thunder, and we have a faint representation of the human and elemental uproar in the midst of which the demure disciple of Pythagoras attempts to erect his quiet schoolroom and exercise his contemplative functions. A man who in such a situation could preserve the continuity of his mental abstractions would hardly lose his philosophical composure amid the tumults of an earthquake or even the falling fragments of a dissolving universe." [17]

The schoolmaster at sea labored under many disadvantages. He had no authority to compel obedience or command attention to his instruction and precepts. The midshipmen looked down upon him as a landlubber, a rankless non-militant and a civilian idler. Moreover, until 1842 when Congress came to his relief, the naval pedagogue was often quartered on board with his pupils and slept and ate with them. His sleeping quarters, however, might be assigned "in the cockpit, below the midshipmen." Sometimes he messed in the "starboard steerage." His familiar association with his pupils, his lowly station, and his rankless office, made impossible the exercise of the rightful authority of a pedagogue. Moreover, only two-thirds of his pupils could attend school at one time, since the remaining third must be on duty. Of those who attended, one-half had been on deck from midnight until four o'clock in the morning, and the other half from four

[17] Officers' Letters, Navy Dept. Arch., Nov., 1831, no. 84.

until eight o'clock. Under these circumstances the pupils were inevitably dull and listless. Besides, they were liable to be called from the schoolroom at any time to help with the work of the ship. It is not surprising that frequently the schoolmaster, after vainly trying to keep school at the beginning of his cruise, abandoned formal instruction, and turned his attention to teaching individually the few bright and inquiring minds that were bent on obtaining knowledge.

The picture of the schoolmaster at sea during the third and fourth decades of the nineteenth century which was drawn by Lieutenant Matthew F. Maury from his own experience may be shaded a trifle too darkly. Maury tells us that the first ship that he sailed in had a schoolmaster from Connecticut. "He was qualified and well disposed to teach navigation, but not having a schoolroom, or authority to assemble the midshipmen, the cruise passed off without the opportunity of oranizing his school. From him, therefore, we learned nothing. On my next cruise, the dominie was a Spaniard; and, being bound to South America, there was a perfect mania in the steerage for the Spanish language. In our youthful impetuosity we bought books, and for a week or so, pursued the study with great eagerness. But our spirits began to flag, and the difficulties of *ser* and *estar* finally laid the cope-stone for us over the dominie's vernacular. The study was exceedingly dry. We therefore voted both teacher and grammar a bore, and, committing the latter to the deep, with one accord declared in favor of the Byronical method—

> 'Tis pleasant to be taught in a strange tongue
> By female lips and eyes—

and concluded to defer our studies until we should arrive in the South American vale of paradise, called Valparaiso."

Maury's next schoolmaster was a "young lawyer, who knew more about *jetsam* and *flotsam* than about lunars and dead reckoning—at least, I presume so, for he never afforded us an opportunity to judge of his knowledge on the latter subject. He was not on speaking terms with the reefers—ate up all the plums for the duff, and was finally turned out of the ship as a nuisance." Another of Maury's teachers he described as an "amiable and accomplished young man from 'the land of schoolmasters and

leather pumpkin seed.' Poor fellow!—far gone in consumption, had a field of usefulness been open to him, he could not have labored in it. He went to sea for his health, but never returned. There was no schoolmaster in the next ship, and the 'young gentlemen' were as expert at lunars and as *au fait* in the mysteries of latitude and departure, as any I had seen. In my next ship, the dominie was a young man, troubled like some of your correspondents, Mr. Editor, with *cacoethes scribendi.* He wrote a book. But I never saw him teaching 'the young idea,' or instructing the young gentlemen in the art of plain sailing; nor did I think it his fault, for he had neither schoolroom nor pupil. Such is my experience of the school system in the Navy; and I believe that of every officer will tally with it." [18]

Schoolmaster George Jones, of the good ship *Constitution,* cruising in the Mediterranean from 1826-28, presents a somewhat brighter picture than Maury's. He says that his school "was placed by Captain Patterson under excellent regulations; a room on one side of the half deck was screened off for us; I had the morning, and the Spanish teacher the afternoon; those who were on my list attended from necessity; many of the rest from choice; and in a short time study was 'all the go' through the steerage, extending itself also into the wardrobe. The cobwebs were soon brushed from their brains, and a more diligent, and I may add successful, set of pupils will no where be found, than in a few weeks were those of our ship. Thus it continued through the summer, much to my gratification, and to the admiration of all who came on board. I placed before them the following course of study: 'the day's work *(Bowditch); Bowditch,* in course; algebra *(Day* or *Riddle);* geometry *(Riddle* or parts of Playfair's *Euclid);* plane trigonometry; analytical trigonometry (the elementary principles of *Riddle);* spherical trigonometry *(Riddle);* investigation of the rules and principles of lunar and other observations *(Riddle).* It is a pretty thorough course; they took it up with ardor, and some have completed it; most had advanced considerably before winter; but winter was fatal to our school. Our exposed room became uncomfortable; I tried to get another, but could not succeed, and the school was

[18] Southern Literary Messenger, VI, 315.

removed to the steerage, where I could exercise no authority, as it was in a private room, and where, amid the noises and confusion of such a place, the spirit of study by degrees evaporated." [19]

From provision for schools on shipboard, it was but a short step to their establishment in the principal navy-yards, where a considerable number of midshipmen were usually on duty. The facilities in the navy-yards for conducting a school were a little better, but the improvement was by no means great. The schoolroom was on board a ship in ordinary, or a receiving ship, or in some building of the navy-yard. The students, being subject to duty either in the yard or on ships temporarily stationed in port, were irregular in their attendance. To other distractions was added that of recreation on shore. Moreover, a midshipman's school-work was liable to be brought to a close any day by an order to join a ship and proceed to sea. When officers were required, the department gave little or no heed to the needs of the schools and their pupils. The number of teachers at the navy-yard schools varied from one to three, and the number of pupils as a rule from five to thirty. The same branches of study were taught as in the schools on shipboard at sea.

The earliest navy-yard school of which I have found a record was established at the Washington yard about 1807. It was at first conducted by Chaplain Robert Thompson "for the purpose of instructing the young gentlemen of the Navy in the theory of navigation." From 1811 to 1814, it was in charge of the Reverend Andrew Hunter, one of the most noted of the early naval chaplains, and a man of much ability and of high character. He had served as a chaplain in the Army of the Revolution, and later as a professor of mathematics and astronomy at Princeton. He owed his appointment to a chaplaincy largely to his abilities as a mathematician. His official title is sometimes given as "chaplain and mathematician in the Navy."

In 1811 when entering upon his duties at the Washington navy-yard, the Reverend Andrew Hunter, at the request of Secretary of the Navy Hamilton, drew up a course of studies to be pursued

[19] George Jones, Sketches of Naval Life, II, 261-262.

by the midshipmen and junior officers. This embraced arithmetic, geometry, trigonometry, logarithms, astronomy, navigation, "geography and the use of the globes," English, a "short course of history and chronology, together with some parts of natural philosophy, particularly mechanics, hydraulics, and some selections of chymistry and electricity." "The time which might be deemed necessary for relaxation from ardent studies," Hunter wrote in blissful ignorance of the recreative tastes and needs of the old-time midshipmen, "might be employed in more extended historical reading and biographical research." He conceived that many useful and ornamental acquirements might be added to those already enumerated. Hunter's school, while a most excellent one, naturally fell short of his high standard.[20]

The war with Great Britain greatly swelled the list of midshipmen of the Navy, and not a few of them received instruction at the Washington navy-yard. Writing to Secretary of the Navy Jones in 1813, Hunter said that, since he entered upon his duties, he had had more than one hundred midshipmen under his tuition, whom he had "endeavored to instruct not only in the theory of their profession, but in such collateral studies as would prepare them for such an appearance and reception in genteel society as would give them influence and reflect honor upon their corps. My pride was that they should be not only mechanical, but scientific, seamen." Unfortunately, some of the young gentlemen did not appreciate their teacher's zealous and painstaking labors in their behalf. They "seemed to spurn what was said with regard to the necessity of their scientific improvement, and supposed that they could acquire a kind of mechanical knowledge by inspection of gunter's scale, or some other way not at all to be depended upon. If they should ever have the command of a ship, Divine Providence or somebody wiser than themselves must direct the helm or the ship and crew will go to ruin." [21]

In October, 1814, Commodore Isaac Chauncey, who was in command of the American naval forces on the Great Lakes, established a mathematical school at Sacketts Harbor, on Lake On-

[20] Captains' Letters, Navy Dept. Arch., 1807, I, no. 54; Officers' Letters, Navy Dept. Arch., V, no. 29; XVI, no. 221.

[21] Officers' Letters, Navy Dept. Arch., XVIII, no. 261; Miscl. Letters, Navy Dept. Arch., LV, no. 116.

tario, under the direction of his chaplain, the Reverend Cheever Felch. It was continued until March, 1815. A letter of Felch to Captain J. D. Elliott, dated December 6, 1814, gives some notion of the character of the chaplain and his work: "My school goes on finely. About 100 officers attend; a number of Lieutenants. I have removed the officers into another room, and have nearly 100 ship's boys in that room. Government ought certainly to make me some compensation for this extra service. I do the duty of eight chaplains. Should time, opportunity, circumstances, etc., favor, you would confer a great obligation on me by sounding the Secretary on the subject." Later, Felch began the preparation of a "System of Studies for Midshipmen," which, however, he was unable to complete, and for which he received several hundred, or possibly a few thousand, dollars.[22]

After the War of 1812 the navy-yards on the seacoast became important manufactories and depots of supplies, and schools were established at several of them, usually on board ships in ordinary. The first of these was organized at the Boston yard in January, 1816, by Chaplain Felch.[23] In September of that year it was attended by forty-three junior officers from the ships *Independence, Congress* and *Macedonian* and from the Boston navy-yard. In 1821 Chaplain David P. Adams started a school at Norfolk. By February, 1822, four navy-yard schools had been established—at Boston, New York, Philadelphia, and Norfolk—which flourished intermittently. In 1824 the New York school was prospering under the tuition of Chaplain Cave Jones. There is some evidence that Jones and Secretary of the Navy Southard regarded this school as the commencement of the naval academy that Southard wished to establish on Governor's Island. From 1827-39 the two principal schools were those at New York and Norfolk. Their chief duty was the preparation of midshipmen for examination to the grade of passed midshipmen. For a time the New York school was held in the loft of one of the shiphouses at the navy-yard; and the Norfolk school, on board the frigate *Java*. In 1833 the latter was commanded by Farragut.

[22] Officers' Letters, Navy Dept. Arch., XXXIII, no. 138; LXV, no. 27; Letters to Officers of Ships of War, Navy Dept. Arch., XIV, 254.

[23] Officers' Letters, XXXIV, no. 126; XXXVI, no. 166; LXV, no. 27.

In January, 1838, there were two teachers and twenty-six students at the New York school; two teachers and four students at the Norfolk school; and one teacher and two students at the Boston school.[24]

A board of naval officers met once a year to examine midshipmen for promotion. For several years its meetings were held in a parlor of Barnum's Hotel, in Baltimore. A professor of mathematics of the Navy often conducted the examinations in mathematics. The line officers always asked the questions in navigation and seamanship. How unique were the examinations of these ancient mariners, Mr. Park Benjamin's bright and breezy pages on the Naval Academy make clear. The midshipmen passed through the ordeal before the board with fear and trembling. Rear-Admiral B. F. Sands has described his experiences in 1834 when sixty-seven midshipmen came up for promotion: The young men were called in one at a time "from the ante-room, which always had some dozen or so 'expectants' in waiting, the names of those who were likely to be called being ascertained the evening before. Other stragglers assembled around the barroom below, awaiting to congratulate the successful or to condole with the unfortunate through the medium of a mint-julep treat by those who joined smilingly as they came from the tribunal. I remember when I came out from the board-room my clothes were damp with perspiration, such was the degree of excitement through which I had gone."[25]

The inefficient work of the navy-yard schools, especially in preparing the midshipmen for their examination for promotion, led in 1839 to a most important advance in naval education. Credit for this must be given to Secretary of the Navy James K. Paulding, Commodore James Biddle, and Professor James McClure, and possibly to Chaplain George Jones. In 1839 Biddle was president of the board of examiners, and also governor of the Naval Asylum, a retreat for aged and decrepit seamen which had been recently established at Philadelphia. In the first half of 1839 he suggested to Paulding that the examining board for

[24] U. S. Navy Register for 1838.

[25] Park Benjamin, United States Naval Academy, 114-118; B. F. Sands, From Reefer to Rear-Admiral, 78.

that year should meet at the asylum, and that a naval school should be established there for the purpose of preparing midshipmen for their future examinations. Biddle evidently desired to correlate the work of the examining board with that of the naval school. He wished to provide a better location for a school than had been found at the navy-yards, and to obtain a more effective control over the students than had hitherto been possible. He thought it was best to make a "very humble beginning," with a single professor to prepare the midshipmen for their examinations in navigation and mathematics. When once the school is clearly under way, he wrote to Paulding, it can be enlarged, both as to the number of students and the branches to be taught, to any extent that you may wish. His plan provided for the discontinuance of the schools at the navy-yards and the concentration of all the educational work of the navy on shore at the Naval Asylum.[26]

Biddle's efforts in behalf of a naval school were re-enforced by those of Professor David McClure, of Philadelphia, a well-known teacher and scientist of that city. In the spring of 1839, McClure, who had been recently disappointed in not obtaining the vice-presidency of Girard College, solicited Secretary Paulding for an appointment to the navy as a professor of mathematics, and urged him to establish a naval academy at Philadelphia, in which McClure hoped to be employed. He discussed these subjects with Paulding while on a visit to Washington.[27] In June McClure received the appointment of professor of mathematics, and in July, at the suggestion of Biddle, he began to prepare a course of studies and some lectures for the proposed school.

Not until near the close of 1839 was the new institution in operation. On November 15, Paulding ordered fifteen midshipmen and Professor McClure to report to Biddle at the "Naval School about to be established at the Naval Asylum." Twenty-four rooms in the basement of the asylum were given up to the midshipmen, who were at first required to room in the building.

[26] Letters to Officers of Ships of War, Navy Dept. Arch., XXVII, no. 106; Captains' Letters, Navy Dept. Arch., March, 1839, no. 68; July, 1839, no. 45.

[27] Philadelphia *Inquirer*, June 22, 1882.

These quarters proved to be, in the words of a report, "damp, cold, cheerless, and unhealthy." Later, largely through the efforts of Lieutenant A. H. Foote, more comfortable rooms were assigned the young gentlemen on one of the upper floors. In the end most of the midshipmen were permitted to find quarters in the city. From time to time Biddle issued regulations for his school. The hours of instruction were fixed from 9 A. M. to 2 P. M. McClure was to report monthly on the progress and merits of his students. These reports together with an annual report of Biddle were to be laid before the examining board, which in the future was to meet at the asylum. The attendance of the midshipmen at chapel on Sunday was required. They were forbidden to play cards. The lights in their rooms were to be out by 9 P. M. They could not leave the grounds without permission.[28]

The attempts of Biddle and his successors to subject the midshipmen to a scholastic regimen were not wholly successful. They did not take kindly to "Biddle's Nursery," as they called the new establishment. When the monotony and routine became duller than they could well bear, they sought enlivenment in quarrels among themselves or with the populace of the city. The *Philadelphia Daily Chronicle* of November 12, 1842, informs us that a "Gentleman was stabbed last evening at the menagerie, corner of Thirteenth and Spruce Streets, by a young midshipman. The wound, it is feared, will prove fatal." Fortunately, the injury was slight. In the days when midshipmen fought duels on the least provocation, they did not permit the rules of the Naval School to interfere with these gentlemanly exercises. A brief account of a breach of this sort is given in a letter of the governor of the Naval Asylum to the Secretary of the Navy, dated October 23, 1842: "On the 20th instant Midshipman Knapp left the Asylum without permission, and yesterday morning fought a duel with Midshipman Rhind at Burlington, in which he received a wound in the face just below the upper cheek bone, which is said to be severe but not dangerous. Midshipmen Downes and Guest accompanied Midshipman Knapp on the ground, the former

[28] Letters to Officers of Ships of War, Navy Dept. Arch., XXVIII, 144; Shippen, Origin of the Naval Asylum, 138; Daniel Ammen, The Old Navy and the New, 94-98; Captains' Letters, Navy Dept. Arch., Feb. 1840, no. 14.

as second, the latter as a friend in case of need, both of these officers left the Asylum without leave. I have therefore ordered their liberty to be stopped until the decision of the Department is made known to me."[29]

In February, 1842, the Naval School was closed, owing to an epidemic of small-pox. In April it was opened again, under new auspices. Commodore James Barron had succeeded Biddle as Governor of the asylum and superintendent of the school, and William Chauvenet had taken the place of McClure as professor of mathematics. The coming of Chauvenet, a brilliant young teacher and mathematician, began a new era in the history of the school. He at once improved its instrumental equipment and library, which he found very deficient. He prescribed a more rigorous course of studies in mathematics, and introduced new textbooks, having found *Bowditch* too elementary. In 1843 a fixed course of study, beginning in the fall and continuing for a scholastic year, was at his suggestion approved by Secretary of the Navy Henshaw.[30] A teacher of French had been added in 1840.

In January, 1844, Chauvenet drew up a curriculum, covering two years' work, and including courses in algebra, geometry, plane and spherical trigonometry, navigation, nautical astronomy, nautical surveying, "mechanics and the steam engine," drawing, gunnery, naval tactics, the French and Spanish languages, naval history, and maritime law. The students were to spend their summers on practice cruises. Entrance to the school was to be upon examination. Seven teachers were to give instruction. On January 25, 1844, the new plan was approved by Secretary Henshaw.[31] In accordance with it, in March he ordered Lieutenant J. H. Ward to the Naval School to give a course of lectures on ordnance and gunnery. Ward's lectures were delivered in April and May, 1844, and early in 1845 they were printed. This book is the first of a considerable number of valuable works treating of technical and professional subjects, which have been published by the officers and professors of the Naval Academy.

[29] Captains' Letters, Navy Dept. Arch., Oct. 1842, no. 180.

[30] Officers' Letters, Navy Dept. Arch., Aug. 1843, no. 67; Oct. 1843, no. 89.

[31] Officers' Letters, Navy Dept. Arch., Jan. 1844, no. 102; Letters to Officers of Ships of War, Navy Dept. Arch., XXXVI, 219.

New Secretaries of the Navy often exhibit toward the work of their predecessors a fatuous ignorance. They have an itch to change something, no matter what. Often they fall foul of a new set of advisers. No better illustration of these facts can be found than the order of Secretary of the Navy Mason of September 9, 1844, which revoked Henshaw's order of the previous January approving Chauvenet's course of study.[32] Mason justified his action on the ground that the midshipmen could not be spared two years from sea. He, however, did not entirely abandon Chauvenet's plan, for he considerably increased the number of teachers at the Naval School. In April, 1845, these comprised William Chauvenet, instructor in mathematics; Julius Meire, instructor in French and Spanish; J. H. Belcher, instructor in international law; H. H. Lockwood, instructor in pyrotechnics; and William F. Mercier, assistant to Lieutenant Ward in ordnance and gunnery. The first four men were professors of mathematics in the Navy, and Mercier was a third assistant engineer. Ward may be considered a member of the faculty, although not in residence. Late in the spring of 1845 Passed Midshipman Samuel Marcy was ordered to the Naval School as the assistant of Chauvenet in mathematics. In April, the number of midshipmen in attendance was forty-six.

It is evident that, as compared with the schools at sea and at the navy-yards, the Naval School at Philadelphia marks a distinct advance. A considerable step had been taken toward the establishment of a naval academy. The new school went far toward consolidating the work of naval instruction on shore, and it correlated the work of instruction with that of the examining board of midshipmen for promotion. In faculty, curriculum, discipline, and location, it was a decided improvement over all previous naval schools. In the fall of this year, 1845, George Bancroft, then Secretary of the Navy, upon the recommendation of a board of officers, moved the school to Fort Severn at Annapolis. There, in 1850, it received its present name, United States Naval Academy.

[32] Letters to Officers of Ships of War, Navy Dept. Arch., XXXVII, no. 167.

ELEMENTARY POINTS OF THE TREATY LIMITING ARMAMENTS

LIEUTENANT W. E. DOYLE, U. S. NAVY

MANY able articles have been published on the Limitation of Armaments Treaty, some of them written by experts who were in close touch with the makers of the treaty. These writings have been very interesting and instructive; but most of them have discussed the treaty from the broad international viewpoint, and they have generally presupposed a knowledge on the reader's part of the details settled by the treaty.

After an average amount of such reading, the writer found that his knowledge of what had actually been done at the Washington Conference was still vague. The experts simply refused to bring themselves down to a discussion of the simple points of the treaty, such as how long it will remain in force, when will the allowed replacements bring the capital ship fleet of Great Britain down to the same number of ships as our fleet, what peace time war-construction is permitted on merchant vessels—in short the many elementary points which are of interest to the practical naval officer.

The writer's interest along these lines was stimulated very effectively when he made the discovery that the Naval Examining Board has lately displayed a marked curiosity regarding the Limitation of Armaments Treaty, as evidenced by some of the questions appearing in recent professional examinations for line officers. Judging from these examination questions, the Board is not so much interested in discussions of the international balance of power as it is in finding out whether an officer knows the answers to definite questions regarding some practical stipulation of the treaty. In search of such definite information, the writer made a visit to a well equipped naval library with the notion of finding some brief summary of the points covered by the Conference, and particularly those covered by the Limitation

of Armaments Treaty. The obliging librarian stated that the information requested was available, and he thereupon produced several volumes that varied from about the size of the well-known work on seamanship to the dimensions of a small suitcase. Since the librarian could not be persuaded to bring out any nice thin books on the subject, the treaties themselves were consulted in the hope of finding a short cut. It soon became apparent that the treaties had to be studied very carefully and laboriously, in order to follow out the intricate technical language and miss none of the involved cross references between articles and sections.

After a considerable amount of such work the writer compiled in non-technical language a set of notes which he believes covers the main points of the Limitation of Armaments Treaty. With the idea of saving others who may be similarly interested the labor of compiling this information, these notes are presented as briefly as possible in the following paragraphs. In all cases where the words are quoted directly from the treaty, they are inclosed in quotation marks.

"Treaty between the United States of America, the British Empire, France, Italy and Japan, Limiting Naval Armaments"

The treaty will come into force on the date of the deposit of all ratifications, of the five contracting powers, in the archives of the United States Government at Washington, D. C.

(Writer's note: The deposit of all ratifications took place, and the treaty came into force, on August 17, 1923.)

The treaty will remain in force until December 31, 1936; and in order to terminate it on that date, or any subsequent date, the power wishing to terminate must give two full years previous notice to the other contracting powers. In case any one power gives such notice, the treaty automatically terminates at the end of the two-year period for all the contracting powers.

"A capital ship, in the case of ships hereafter built, is defined as a vessel of war, not an aircraft carrier, whose displacement exceeds 10,000 tons standard displacement, or which carries a gun with a caliber exceeding eight inches."

It must be borne carefully in mind that the above treaty defini-

tion of a capital ship applies, as stated, to ships that are built after the treaty comes into force, and not to ships already built or building. When the treaty speaks of capital ships and is referring to ships already built or building, it means only battleships and battle cruisers, without regard to displacement or gun power. A reader of the treaty must decide which meaning is intended, when a capital ship is mentioned, by noticing whether the reference is to a capital ship to be built after the treaty comes into force, or to one which is already built or building.

In the meaning of the treaty, retained capital ships are the particular ships, already built or building, that each power is allowed to retain until they are ready to be scrapped due to age; and replacement capital ships are the ships that will be built, after the treaty is in force, to replace the retained ships when the latter have reached the age limit set by the treaty. The distinction between retained capital ships and replacement capital ships must constantly be borne in mind, because the two are handled quite differently throughout the treaty.

The powers agree to limit capital ship and aircraft carrier tonnage as follows: the United States to a replacement tonnage of 525,000 for capital ships and 135,000 for aircraft carriers; the British Empire to a replacement tonnage of 525,000 for capital ships and 135,000 for aircraft carriers; Japan to a replacement tonnage of 315,000 for capital ships and 81,000 for aircraft carriers; France to a replacement tonnage of 175,000 for capital ships and 60,000 for aircraft carriers; and Italy to a replacement tonnage of 175,000 for capital ships and 60,000 for aircraft carriers.

The powers agree to limit the tonnage and gun power of replacement capital ships to 35,000 and sixteen-inch caliber, respectively.

The tonnage of aircraft carriers is limited to 27,000, except that any power may build not more than two aircraft carriers of 33,000 tons, provided the total aircraft carrier tonnage for the power is not thereby exceeded. No aircraft carrier can mount a gun larger than eight-inch. If an aircraft carrier is of greater displacement than 27,000 tons, and if any of its guns are larger than six-inch, then the total number of guns shall not exceed

eight. If an aircraft carrier is not of greater displacement than 27,000 tons, and if any of its guns are larger than six-inch, then the total number of guns shall not exceed ten. If an aircraft carrier has no guns larger than six-inch, then the total number of guns is not limited. Irrespective of displacement and guns larger than six-inch, there shall be no limitation for any aircraft carrier as to the number of anti-aircraft guns or guns not exceeding five-inch—any number of these may be carried.

No replacement capital ship or aircraft carrier can itself be replaced by a new one until it is at least twenty years old. By special provisions of the treaty, however, certain retained ships can be replaced by new ones before they are twenty years old. These special provisions will be noted in later paragraphs.

The powers agree that any aircraft carrier in existence, or building, on November 12, 1921, shall be considered experimental, and that all such can be replaced at any time, irrespective of age, provided the maximum tonnage allowed for each vessel and the total maximum aircraft carrier tonnage are not exceeded.

In case of loss or accidental destruction of a capital ship or aircraft carrier, it may be replaced at once, regarding only tonnage requirements.

The retained capital ship tonnage for the United States is as follows: *West Virginia, Colorado, Maryland, California, Tennessee, Idaho, New Mexico, Mississippi, Arizona, Pennsylvania, Oklahoma, Nevada, New York, Texas, Arkansas, Wyoming, Florida* and *Utah*—a total of eighteen ships aggregating a retained tonnage of 525,850.

The retained capital ship tonnage for the British Empire is as follows: Battleship *A*, Battleship *B* (the treaty permits these two ships to be built at any time, but they are limited to the standard displacement of 35,000 tons), *Ramillies, Royal Sovereign, Royal Oak, Resolution, Revenge, Valiant, Malaya, Queen Elizabeth, Warspite, Barham, Benbow, Emperor of India, Iron Duke, Marlborough, Hood, Renown, Repulse* and *Tiger*—a total of twenty ships, aggregating a retained tonnage of 558,950.

Until Battleships *A* and *B* are completed, Great Britain is permitted to retain the *Thunderer, King George V, Ajax* and *Centurion*. (Writer's note: The British have, since signing the

treaty, laid down the *Nelson* and the *Rodney*, as the two battleships *A* and *B*, and these two vessels are to be completed in 1925.)

The retained capital ship tonnage for Japan is as follows: *Mutsu, Nagato, Hiuga, Ise, Yamashiro, Fu-So, Kirishima, Haruna, Hiyei* and *Kongo*—a total of ten ships, aggregating a retained tonnage of 301,320.

The retained capital ship tonnage for France is as follows: *Lorraine, Provence, Bretagne, Paris, France, Jean Bart, Courbet, Condorcet, Diderot* and *Voltaire*—a total of ten ships, aggregating a retained tonnage of 221,170. France may lay down new tonnage in 1927 and in 1929, not to exceed 35,000 tons either year.

The retained capital ship tonnage for Italy is as follows: *Andrea Doria, Caio Duilio, Conte Di Cavour, Guilio Cesare, Leonardo Da Vinci, Dante Alighieri, Roma, Napoli, Vittorio Emanuelo* and *Regina Elena*—a total of ten ships, aggregating a retained tonnage of 182,800. Italy may lay down new tonnage in 1927 and in 1929, not to exceed 35,000 tons either year.

It is agreed that all other capital ships, built or building, of the United States, the British Empire and Japan shall be scrapped, except that these powers are permitted to use any two of their ships, built or building, which would otherwise be scrapped, for the purpose of converting them into aircraft carriers, these latter not to exceed 33,000 tons each; provided the United States is permitted to retain the *Oregon* and the *Illinois* for noncombatant purposes, the British Empire is permitted to retain the *Colossus* and *Collingwood* for noncombatant purposes, and Japan is permitted to retain the *Shikishima* and *Asahi* for noncombatant purposes. France and Italy will eventually be allowed two noncombatant capital ships, by the provision which permits them to save two ships out of those which would otherwise be scrapped in or after the year 1931. France is permitted to keep two of the *Jean Bart* class; Italy is permitted to keep one of the *Dante Alighieri* class and one of the *Guilio Cesare* class.

None of the retained ships named in the treaty can be reconstructed, except that a maximum increase in the displacement of each ship is permitted of 3,000 tons, solely for improvements in protection against aircraft and submarines, which may include the construction of a bulge or blister or an anti-aircraft deck.

"No alteration in side armor, in caliber, number, or general type of mounting of main armament shall be permitted."

The powers agree that they will not, in time of war, use any vessel or vessels which may be under construction within their jurisdiction for a foreign power.

It is agreed that, excepting the two battleships *A* and *B* (*Nelson* and *Rodney*) which the British Empire is permitted to build at any time and with the further exception of the new tonnage that France and Italy are permitted to lay down in 1927 and in 1929, there shall be no capital ships laid down by any of the contracting powers until ten years from November 12, 1921.

During a period of fifteen to twenty years after the ratification of the treaty, retained ships will gradually be displaced by replacement ships; and the powers agree to definite replacement schedules setting forth the earliest times vessels may be replaced, the number of replacement vessels that each power can add to its fleet in any one year, and the number of retained vessels that must be scrapped per year. When all retained vessels have been replaced, there will be no further need of replacement schedules, because the powers will then be governed by the general stipulations of the treaty that: (a) all capital ships and aircraft carriers must be twenty years old before they can be replaced; (b) the keels for replacement vessels can not be laid earlier than seventeen years from the date of completion of the tonnage to be replaced; (c) no capital ship or aircraft carriers can exceed 35,000 tons and 27,000 tons, respectively; and (d) the total replacement tonnages for capital ships and aircraft carriers must not be exceeded.

The treaty schedule for the United States permits keels to be laid for capital ships, to make replacements, as follows:

two in 1931 to replace *Wyoming, Florida* and *Utah;*
two in 1932 to replace *New York, Texas* and *Arkansas;*
one in 1933 to replace *Oklahoma* and *Nevada;*
two in 1934 to replace *Pennsylvania* and *Arizona;*
one in 1935 to replace *Mississippi;*
two in 1936 to replace *New Mexico* and *Idaho;*
one in 1937 to replace *Tennessee;*

two in 1938 to replace *California* and *Maryland;*
two in 1939 to replace *Colorado* and *West Virginia.*

The schedule for the British Empire permits keels to be laid for capital ships as follows:

two in 1931 to replace *Benbow, E. India, I. Duke* and *Marlborough;*
two in 1932 to replace *Tiger, Q. Elizabeth, Barham* and *Warspite;*
one in 1933 to replace *Royal Sovereign* and *Malaya;*
two in 1934 to replace *Revenge* and *Resolution;*
one in 1935 to replace *Royal Oak;*
two in 1936 to replace *Repulse* and *Valiant;*
one in 1937 to replace *Renown;*
two in 1938 to replace *Hood* and *Ramillies;*
two in 1939 to replace *Nelson* and *Rodney.*

The schedule for Japan permits keels to be laid for capital ships as follows:

one in 1931 to replace *Kongo;*
one in 1932 to replace *Haruna* and *Hiyei;*
one in 1933 to replace *Kirishima;*
one in 1934 to replace *Fu-So;*
one in 1935 to replace *Yamashiro;*
one in 1936 to replace *Ise;*
one in 1937 to replace *Hiuga;*
one in 1938 to replace *Nagato;*
one in 1939 to replace *Mutsu.*

The number of new ships allowed each year, in the above schedules for the United States, the British Empire and Japan must not be exceeded, irrespective of tonnage considerations. If, for example, a schedule for one of these three powers permits two ships to be laid down during a certain year, these ships may have any displacement up to 35,000 each, or a total of 70,000 tons; but the schedule would not permit more than two ships to be laid down in that year, even though their total tonnage were kept within 70,000. The treaty does not place this limitation upon France and Italy. The schedules for these two powers give

the total replacement tonnage allowed for certain years, and this tonnage may be alloted as France and Italy consider advisable, subject solely to the limitations that the displacement of individual ships shall not exceed 35,000 tons, and the total capital ship tonnage must be kept within the limits set by the treaty.

The schedule for France permits tonnage to be laid for capital ships as follows:

35,000 tons in 1927 to replace *Jean Bart* and *Courbet;*
35,000 tons in 1929 to replace *France;*
35,000 tons in 1931 to replace *Paris* and *Bretagne;*
35,000 tons in 1932 to replace *Provence;*
35,000 tons in 1933 to replace *Lorraine.*

The schedule for Italy permits tonnage to be laid for capital ships as follows:

35,000 tons in 1927 to replace *Dante Alighieri;*
35,000 tons in 1929 to replace *Leonardo Da Vinci;*
35,000 tons in 1931 to replace *Guilio Cesare;*
45,000 tons in 1932 to replace *Conte Di Cavour* and *Duilio;*
25,000 tons in 1933 to replace *Andrea Doria.*

Of the ten capital ships that the treaty permits France to retain, the *Condorcet, Diderot* and *Voltaire* are old type battleships, and the seven others are dreadnaughts; of the ten which Italy is permitted to retain, the *Roma, Napoli, Vittorio Emanuelo* and *Regina Elena* are old type battleships, and the remaining six are dreadnaughts. The replacement schedules for these two powers provide definitely for the scrapping of the dreadnaughts when new capital ship tonnage is completed, but no definite provision is made for scrapping the old type battleships. In fact they are not considered at all in any part of the treaty except where they are named among the vessels that may be retained. This will permit France and Italy to retain these old type battleships for an indefinite period—until the mounting total of newly constructed tonnage makes it necessary to scrap them in order to keep within the tonnage limits set for each power by the treaty.

The wording of the treaty is such, regarding these replacement schedules, that the years set forth for laying down the keels of new capital ships represent the earliest possible times within

the limitations of the treaty for beginning the construction of these ships; but none of the powers is obligated to construct new tonnage at any certain times or within any specified periods—the schedules act merely as a brake on new construction. The treaty provides, however, that in case a keel is laid for an authorized replacement, the scrapping of the old vessel shall be commenced within four years from the laying of the keel of the replacement vessel, whether the new one is completed or not.

The replacement schedules are based on ages of ships, but the treaty provides that any power may retain an older ship and scrap a newer one when making replacements, so long as the number of ships called for in the schedule are scrapped each year.

All the ships which are to be scrapped immediately upon ratification of the treaty must by the end of six months from the date of ratification be rendered unfit for war service of any kind, and they must be totally scrapped by the end of eighteen months. These same limiting periods apply when a vessel is to be scrapped to make way for replacement tonnage. In the meaning of the treaty a ship is totally scrapped when it is either permanently sunk in deep water or entirely broken up. The only exception to this is the provision which permits each Power to retain one capital ship that would otherwise be totally scrapped, for use as a target vessel. When this is done, the ship so used must at all times be in a condition unfit for war services, which means that its guns, ammunition and explosives must be removed, its turret machinery must be wrecked or taken off, and it must be stripped of all fire control and aircraft gear.

Following is the agreement between the United States, the British Empire and Japan, regarding fortifications in the Pacific, taken word for word from the treaty:

"The United States, the British Empire and Japan agree that the status quo at the time of the signing of the present treaty, with regard to fortifications and naval bases, shall be maintained in their respective territories and possessions specified hereunder:

"(1) The insular possessions which the United States now holds or may hereafter acquire in the Pacific Ocean, except (a) those adjacent to the coast of the United States, Alaska and the Panama Canal Zone, not including the Aleutian Islands, and (b) the Hawaiian Islands;

"(2) Hong Kong, and the insular possessions which the British Empire now holds, or may hereafter acquire in the Pacific Ocean, east of meridian 110 degrees east longitude, except (a) those adjacent to the coast of Canada, (b) the Commonwealth of Australia and its territories, and (c) New Zealand;

"(3) The following insular territories and possessions of Japan in the Pacific Ocean, to wit: the Kurile Islands, the Bonin Islands, Amami-Oshima, the Loochoo Islands, Formosa and the Pescadores, and any insular territories or possessions in the Pacific Ocean which Japan may hereafter acquire.

"The maintenance of the status quo under the foregoing provisions implies that no new fortifications or naval bases shall be established in the territories and possessions specified; that no measures shall be taken to increase the existing naval facilities for the repair and maintenance of naval forces, and that no increase shall be made in the coast defenses of the territories and possessions above specified. This restriction, however, does not preclude such repair and replacement of worn out weapons and equipment as is customary in naval and military establishments in time of peace."

TABLE OF REPLACEMENTS

The following table shows from 1922-42, for the five treaty powers, the number of pre-Jutland and post-Jutland capital ships that each power will possess for any one year. The total number of capital ships possessed by any of these powers can be determined for any one year by adding the pre-Jutland and post-Jutland ships of the power for that year. Replacement tonnage does not affect the figures of the table until the years in which new ships are due for completion, and the treaty estimate is that all the powers will complete new ships within three years after laying their keels, except in the case of Italy, for which the treaty estimate is four years.

	United States		Great Britain		Japan		France		Italy	
	Pre Jutland	*Post Jutland*	*Pre Jutland*	*Post Jutland*	*Pre Jutland*	*Post Jutland*	*Pre Jutland*	*Post Jutland*	*Pre Jutland*	*Post Jutland*
1922	15	3	21	1	8	2	7	0	6	0
1923	15	3	21	1	8	2	7	0	6	0
1924	15	3	21	1	8	2	7	0	6	0
1925	15	3	17	3	8	2	7	0	6	0
1926	15	3	17	3	8	2	7	0	6	0
1927	15	3	17*	3	8	2	7	0	6	0

	United States		Great Britain		Japan		France		Italy	
	Pre Jutland	*Post Jutland*	*Pre Jutland*	*Post Jutland*	*Pre Jutland*	*Post Jutland*	*Pre Jutland*	*Post Jutland*	*Pre Jutland*	*Post Jutland*
1928	15	3	17	3	8	2	7	0	6	0
1929	15	3	17	3	8	2	7	0	6	0
1930	15	3	17	3	8	2	5	*	6	0
1931	15	3	17	3	8	2	5	*	5	*
1932	15	3	17	3	8	2	4	*	5	*
1933	15	3	17	3	8	2	4	*	4	*
1934	12	5	13	5	7	3	2	*	4	*
1935	9	7	9	7	5	4	1	*	3	*
1936	7	8	7	8	4	5	0	*	1	*
1937	5	10	5	10	3	6	0	*	0	*
1938	4	11	4	11	2	7	0	*	0	*
1939	2	13	2	13	1	8	0	*	0	*
1940	1	14	1	14	0	9	0	*	0	*
1941	0	15	0	15	0	9	0	*	0	*

* Number of vessels not fixed—the treaty permits France and Italy to employ the capital ship tonnage allotment as they see fit, subject solely to the limitations that displacement of individual ships shall not exceed 35,000 tons and that they keep within their total tonnage allotments of 175,000 tons each.

THE RETAINED CAPITAL SHIP FLEET OF THE UNITED STATES

Year was Finished	*Name*	*Displacement*	*Armor*	*Speed Knots*	*Main Battery*
1923	*West Virginia*	32,600	16-18″	21	8 16″-45 Cal
1923	*Colorado*	32,600	16-18″	21	8 16″-45 Cal
1922	*Maryland*	32,600	16-18″	21	8 16″-45 Cal
1921	*California*	32,300	14-18″	21	12 14″-50 Cal
1920	*Tennessee*	32,300	14-18″	21	12 14″-50 Cal
1919	*Idaho*	32,000	14-18″	21	12 14″-50 Cal
1918	*New Mexico*	32,000	14-18″	21	12 14″-50 Cal
1917	*Mississippi*	32,000	14-18″	21	12 14″-50 Cal
1916	*Arizona*	31,400	14-18″	21	12 14″-45 Cal
1916	*Pennsylvania*	31,400	14-18″	21	12 14″-45 Cal
1916	*Oklahoma*	27,500	13-18″	21	10 14″-45 Cal
1916	*Nevada*	27,500	13-18″	21	10 14″-45 Cal
1914	*New York*	27,000	12-14″	21	10 14″-45 Cal
1914	*Texas*	27,000	12-14″	21	10 14″-45 Cal
1912	*Arkansas*	26,000	11-12″	21	12 12″-50 Cal
1912	*Wyoming*	26,000	11-12″	21	12 12″-50 Cal
1911	*Florida*	21,825	11-12″	21	10 12″-45 Cal
1911	*Utah*	21,825	11-12″	21	10 12″-45 Cal

THE RETAINED CAPITAL SHIP FLEET OF THE BRITISH EMPIRE

Year was Finished	*Name*	*Displacement*	*Armor*	*Speed Knots*	*Main Battery*
1925	*Nelson*	35,000	10-13″	23	9 16″-.. Cal
1925	*Rodney*	35,000	10-13″	23	9 16″-.. Cal
1917	*Ramillies*	25,750	10-13″	23	8 15″-42 Cal
1916	*R. Sovereign*	25,750	10-13″	23	8 15″-42 Cal
1916	*Royal Oak*	25,750	10-13″	23	8 15″-42 Cal
1916	*Resolution*	25,750	10-13″	23	8 15″-42 Cal
1916	*Revenge*	25,750	10-13″	23	8 15″-42 Cal
1916	*Valiant*	27,500	10-13″	25	8 15″-42 Cal
1916	*Malaya*	27,500	10-13″	25	8 15″-42 Cal
1915	*Q. Elizabeth*	27,500	10-13″	25	8 15″-42 Cal
1915	*Warspite*	27,500	10-13″	25	8 15″-42 Cal
1915	*Barham*	27,500	10-13″	25	8 15″-42 Cal
1914	*Benbow*	25,000	10-12″	21	10 13.5″-45 C
1914	*Emp. of India*	25,000	10-12″	21	10 13.5″-45 C
1914	*Iron Duke*	25,000	10-12″	21	10 13.5″-45 C
1914	*Marlborough*	25,000	10-12″	21	10 13.5″-45 C
1920	**Hood*	41,200	6-12″	32	8 15″-42 Cal
1916	**Renown*	26,500	6- 9″	30	6 15″-42 Cal
1916	**Repulse*	26,500	6- 9″	30	6 15″-42 Cal
1914	**Tiger*	28,500	6- 9″	28	8 13.5″-45 C

* Battle cruisers.

THE RETAINED CAPITAL SHIP FLEET OF JAPAN

Year was Finished	*Name*	*Displacement*	*Armor*	*Speed Knots*	*Main Battery*
1922	*Mutsu*	33,800	12″	23	8 16″-45 Cal
1921	*Nagato*	33,800	12″	23	8 16″-45 Cal
1918	*Hiuga*	31,260	12″	23	12 14″-45 Cal
1917	*Ise*	31,260	12″	23	12 14″-45 Cal
1917	*Yamashiro*	30,600	12″	22	12 14″-45 Cal
1915	*Fu-So*	30,600	12″	22	12 14″-45 Cal
1915	**Kirishima*	27,500	8-10″	27	8 14″-45 Cal
1915	**Haruna*	27,500	8-10″	27	8 14″-45 Cal
1914	**Hiyei*	27,500	8-10″	27	8 14″-45 Cal
1913	**Kongo*	27,500	8-10″	27	8 14″-45 Cal

* Battle cruisers.

THE RETAINED CAPITAL SHIP FLEET OF FRANCE

Year was Finished	*Name*	*Displacement*	*Armor*	*Speed Knots*	*Main Battery*
1915	*Bretagne*	23,500	10-17″	21	10 13.4″-45 C
1915	*Lorraine*	23,500	10-17″	21	10 13.4″-45 C
1915	*Provence*	23,500	10-17″	21	10 13.4″-45 C
1914	*Paris*	23,500	11-12″	21	12 12″-45 Cal
1914	†*France*	23,500	11-12″	21	12 12″-45 Cal
1913	*Jean Bart*	23,500	11-12″	22	12 12″-45 Cal
1913	*Courbet*	23,500	11-12″	21	12 12″-45 Cal
1911	**Condorcet*	18,890	10-12″	20	4 12″-45 Cal
1911	**Diderot*	18,890	10-12″	20	4 12″-45 Cal
1911	**Voltaire*	18,890	10-12″	20	4 12″-45 Cal

† The *France* foundered in Quiberon Bay in August, 1922.
* Pre-dreadnaught battleships.

THE RETAINED CAPITAL SHIP FLEET OF ITALY

Year was Finished	*Name*	*Displacement*	*Armor*	*Speed Knots*	*Main Battery*
1915	*Andrea Doria*	22,700	8-11″	21	13 12″-46 Cal
1915	*Caio Duilio*	22,700	8-11″	21	13 12″-46 Cal
1915	*Conte Di Cavour*	22,500	8-11″	22	13 12″-46 Cal
1914	*Guilio Cesare*	22,500	8-11″	22	13 12″-46 Cal
1914	*L. Da Vinci*	22,500	8-11″	22	13 12″-46 Cal
1912	*Dan. Alighieri*	19,500	6-11″	22	12 12″-46 Cal
1908	**Roma*	12,600	8- 9″	21	2 12″-40 Cal
1908	**Napoli*	12,600	8- 9″	21	2 12″-40 Cal
1907	**V. Emanuele*	12,600	8- 9″	21	2 12″-40 Cal
1907	**Regina Elena*	12,600	8- 9″	21	2 12″-40 Cal

* Pre-dreadnaught battleships.

AMERICA'S PART IN FOUNDING THE GERMAN NAVY

Rear Admiral Caspar F. Goodrich, U. S. Navy, (Retired)

IN THE *North American Review* for September, Mr. Willis Fletcher Johnson pays a well earned tribute to the men and women of our Russian Relief Mission who toiled for nearly two years amid disease, filth and famine to save an estimated ten millions of lives at an expenditure of American funds amounting to $62,000,000. In return for this noble, altruistic devotion, Soviet Russia "promptly dispatched a numerous contingent of spies and propagandists to enter our borders, furtively on forged passports, to agitate and conspire against and, if possible, to overthrow and destroy the government and the social order which had wrought so great a work for Russia. Incidentally, it at the same time arranged for a huge agricultural exposition and fair to display the prosperity and wealth of the country which had been a suppliant for the succor of the world. Was it not Æsop who told of the man who saved the life of a viper by warming it at his own hearthstone?"

Dubtless, for all time, this will stand as the monumental instance of national ingratitude. But, does it stand alone? Has any other nation profited by our kind assistance in the past only later to turn and, to speak, bite the hand that helped?

For many years I have been familiar with the rumor circulated at Ward Room Messes or Cabin dinners that long ago, when Prussia was establishing a Navy, she appealed to the United States to furnish to her prospective naval officers practical instruction in seamanship, gunnery, navigation, etc., by receiving some of them on board of our men-of-war and also that a distinguished member of our service was offered the highest command in Prussia's contemplated fleet. Recently, I have thought it worth while to look into the records to ascertain what truth, if any, there was in this rumor. Thanks to the courtesy of Captain Luke McNamee,

U. S. Navy, the able Director of Naval Intelligence, I am able to throw some light upon the matter, not as much as could be desired but sufficient to show that our aid was sought by Prussia and, to a certain extent, was accorded by us. Briefly, these are the main facts.

Oddly enough, the whole affair is an outcome of the famous "Schleswig-Holstein Question" of the middle of the last century, concerning which, when asked to explain it, Lord Palmerston made the often quoted enlightening remark, "Only two persons ever understood this intricate and perplexing matter, Count von Münster and myself. I am sorry to say that he is dead and I have forgotten all about it." However, for our purpose, we need only to know a few pertinent phases of this international will-o'-the-wisp.

In 1846, Christian VIII of Denmark proclaimed that Schleswig and the greater part of Holstein were indissolubly connected with the Danish monarchy. This excited vehement opposition among the Germans on the ground that Holstein, although subject to the King of Denmark was a member of the then existing "German Confederation," established by the Congress of Vienna, and that, in virtue of ancient treaties, it could not be severed from Schleswig. In 1848, the German party in these duchies of Schleswig and Holstein rose against the Danish government. Frederick VII, who had just succeeded Christian VIII, put down the rebellion but Prussia, in the name of the Confederation, dispatched an army against the Danes and drove them from Schleswig. The Danes, who were supported by Russia, responded by blockading the Baltic ports which Germany, having no Navy, was unable effectually to defend. The German people urged the construction of a fleet. Money was collected and a few men-of-war were fitted out; but these were subsequently sold, the German Bundesrat not being in sympathy with the aspirations of the nation. Prussia, however, was determined upon possessing a Navy. Ships of a sort might be procured readily enough but where was she to get the training for her officers in organization, discipline, drills, briefly, in the art of naval warfare? As our Navy then, as always, enjoyed an unrivalled reputation for the education of its personnel and, doubtless also because the United States took no part

in the international quarrels and jealousies common in Europe, Prussia looked to us for aid in this respect.

In the year 1847 there was launched at Gosport (Norfolk, Virginia) the U. S. S. *St. Lawrence* designed to carry a battery of eight 8-inch and forty-two 32-pdr. guns, a splendid specimen of the old time sailing frigate. She was commissioned the following year under the command of that fine seaman, Captain Hiram Paulding, for "special service in Europe and the Mediterranean." On August 29, 1848, just before sailing from Norfolk, the Navy Department directed him, at the request of Baron Gerolt, the Prussian Minister to the United States, to "take on board a Mr. Foester and rate him 'Master's Mate.'" Although not specifically so stated, it is obvious that the object of this courtesy was to initiate this Prussian (evidently meant to be an officer) in the routine and methods of our ships of war. For this end, Captain Paulding was eminently equipped by character and experience.

The *St. Lawrence* sailed from Hampton Roads September 8, and, after touching at the Isle of Wight, anchored on October 7, in the mouth of the River Weser. Next day she was "towed to Bremer Haven by a steamer sent by order of the Senate for that purpose." The officers of the *St. Lawrence* were received in Bremen "with open arms."

After a conference with the ministers of the Prussian government, Captain Paulding reported to the Navy Department that they looked to the United States for help in establishing a Navy, even going so far as to request the loan of ships and officers. Since the war between Prussia had only for the moment ceased and might at any time be renewed, the Prussians' frankness in stating their needs "temporarily to resist the Danes in that event" implies an amusing and typical ignoring of international law. How could we, by any casuistry, take sides in such a struggle?

However, they added significantly that our assistance would be gratefully accepted "permanently, after the Confederation of States is firmly established."

The *St. Lawrence* spent at least two months at Bremen. During that period, Captain Paulding went on an official visit to Berlin, where he was cordially received by the King, Frederick William IV. As a consequence of pourparlers with the King and his min-

isters, four Prussian midshipmen joined the *St. Lawrence.* "As they had no uniforms of their own, they adopted that of the United States." This action of Captain Paulding's was approved by the Navy Department in a letter "thanking him for the manner in which he had performed the special service assigned him."

Following Prussia's lead, Hanover, then an independent kingdom, "made application to have midshipmen employed in the United States Naval Service on the same terms as had been granted the Prussian midshipmen on the *St. Lawrence.*" "Our Minister to Prussia and Germany [note the differentiation], through whom this request was made, recommended that place be reserved for twenty on the next ships fitted out for the European Station. He presumed that more [ships] would be shortly sent owing to the unsettled state of Europe and impending war."

No objection could be urged by any other power against Prussia's and Hanover's desire during peace, but fearing that this step might only be the prelude to others of more questionable nature, Commodore Foxhall A. Parker, U. S. Navy (the first of this honored name) was sent, December 16, 1848, on a confidential mission to Berlin and Frankfort "to inform himself fully regarding the exact service desired by the Germanic Confederation from officers of the American Navy," then to return to the United States and report at length. In a letter of January 24, 1849, he recounted in detail his visit to the King of Prussia, January 15, his arrival at Frankfort, January 17, "and his conference with the German ministers regarding the service desired in the formation of their Navy from officers of the United States. He was informed that the German government had ordered a vessel to be purchased (here) through its agent in the United States and desired that it might be officered by United States Naval Officers."

Commodore Parker believed and stated that, in his opinion, it would be "unwise for officers of the American Navy to have anything to do with Germany until the Central Power is established."

A steamship named the *United States* was bought in New York for the Germanic Confederation and, on February 19, 1849, at the request of the German Minister in Washington, Baron Roenne, Captain M. C. Perry, U. S. Navy, who was later to open up Japan, was "directed by the Navy Department to assist in has-

tening her preparation and fitting out." A few days later, the Commandant of the New York Navy Yard was ordered "to afford all necessary facilities at the yard for the same purpose."

Commodore Parker arrived in Washington on February 25, but his prudent council appears not to have been accepted. It required the protest of the Danish Minister, Mr. Billé, to stop the sailing of the *United States* from New York "unless a bond was given that she was not intended to war against any power at peace with the United States of America." On May 25, the State Department was informed that "the bond had been executed and the ship sailed. Her arrival at Liverpool was reported June 22 and her name changed to *Horsa*." Whether she took part in hostilities against Denmark is not of record but it is a fair presumption that she did not. At least it is certain that we furnished one of the earliest vessels to appear on the Prussian Navy List.

In the meanwhile, on March 1, "the President authorized Captain Paulding to receive on board the *St. Lawrence* Mr. von Poyrell, of Minden, Westphalia, at the request of the German Minister and Captain McKeever [at the New York Navy Yard] is desired to receive on board the first United States vessel of war in commission a young Prussian, named Olearius, as midshipman, no pay or emoluments to be allowed him."

Captain Paulding's care and instruction of the German midshipmen on board the *St. Lawrence* must have been highly satisfactory to their government and his personality have commanded their respect else his daughter could not have stated in his biography that "Perhaps few men would have declined the honor offered when the Prussians desired him to head their own Navy."

It is evident that the German Navy at the outset was largely founded on American lines under Paulding's wise guidance, although at this late date and without access to the archives of the German Admiralty it is difficult to adduce incontrovertible evidence. Such slight acquaintance with German men-of-war as was mine, about twenty years after Paulding's experience, revealed a marked similarity between their organization and ours. This, however, was an impression rather than the result of close study.

From such a small beginning grew the formidable fleet, which for a time was able to dispute the supremacy of the seas with the British, and which, before our entrance into the World War, inflicted such damage upon us, who had helped to create it. We may well wonder to what extent it would have grown, and how great its ultimate cost might have been to us, had it not met its eclipse in the humiliating surrender at Scapa Flow.

REPORT ON THE FITNESS OF OFFICERS

By Commander J. O. Richardson, U. S. Navy

THE present form of the Report on the Fitness of Officers, adopted in October, 1921, is a great improvement over the older form, but I believe that this report can be materially improved and that it should be changed.

Any one who has examined the reports of fitness of a number of officers has noted that most of the reports are excellent. It is generally remarked that boards of selection find all reports of fitness almost equal and uniformly good, so that judging solely by fitness reports it is almost impossible to distinguish the exceptionally able officer from the average officer. As a rule officers who have been passed over for selection have been able to assert truthfully that their reports of fitness showed that they were above the average.

The form now in use makes provision for an officer being marked, superior, above average, average, below average, or inferior in each of the following nineteen qualifications:

Aptitude for the service
Conduct
Co-operative qualities
Courtesy
Devotion to duty
Education
Force
Industry
Initiative
Judgment
Justice
Leadership
Military manner and bearing
Neatness of person and dress
Patience
Physical energy and endurance
Reliability
Self-control
Subordination

The report also states:

"A mark below average or inferior will be considered unfavorable,"

and the Navy Regulations state:

"Whenever any portion of the report made by the reporting senior is in any sense unfavorable, the reason shall be clearly stated under the head of 'Remarks' and the entire report shall be referred to the officer reported on for his statement with regard to the unfavorable portion."

It is clearly impossible for the majority of the officers of the service to be above the average, yet their fitness reports indicate that they are.

Certainly it is the unusually good officer who is endowed with all of the above qualities in an average or above average degree, and it is manifestly certain that the average officer possesses some of these qualities in a below average degree, yet the above quoted regulations tend to make reporting seniors avoid marking an officer below the average in any desirable qualification.

This results in practically all officers in the Navy being rated average in those qualities in which they are more or less deficient; and above average, or superior, in those qualifications in which no deficiency is noted. Another result is that under item 13, "a general outline of the officer's character," only remarks that are complimentary or non-committal are entered and no mention is made of lack of desirable qualities.

Other reasons for high marking are:

(a) The attitude of the Bureau of Navigation in considering as unfavorable any entry or remark that is not complimentary.

(b) An exaggerated idea in the whole service of the seriousness of having an unfavorable report referred to an officer for comment and the feeling that it is highly discreditable to be marked below average in any desirable qualification.

(c) Reporting seniors dislike to injure an officer's chance for promotion by making other than complimentary entries.

(d) The feeling on the part of some reporting seniors that the officer must be retained on board and if he is shown an unfavorable report he will be so hurt or discouraged that his value will be lessened.

(e) The knowledge on the part of seniors that many officers are uniformly high markers and that it would be unjust to mark his own subordinates by a stricter standard.

As a general rule the present practice results in an officer being shown his report on fitness only when it is unfavorable. The officer reported on is the one that is most concerned, and if his report indicates anything in which improvement is pos-

sible he should see the report in order that he may make an effort to improve his work or himself, and if the report is wholly good it should be shown to him so that he may know that his good work is recognized and appreciated.

On the present form there is no space wherein the officer may indicate the efforts he has made during the period to improve himself. It is generally admitted that our young officers should read and study more professional books than they do, therefore every effort should be made to encourage and to require officers to read and study. This would be partly effected by having the officer state on his fitness reports the names of the books or professional subjects he had read during the period covered by the report.

In the present list of nineteen qualifications there are some substitutions that would improve the quality of the report.

Justice and patience as qualities of character are of course important in an officer, but circumstances are so infrequently such that an accurate estimate can be made, that these qualities could easily be deleted from the report, and if any officer shows either of these qualities, or the lack of them to a marked degree, it could be noted in the general remarks.

Smartness and decisiveness are essential qualifications of a successful officer. These qualities are usually quite evident and they should certainly be included in the report.

Physical energy and endurance, although entered on the form as one item, are not synonymous, nor are they necessarily concomitant. In fact the energetic, high strung, active individual frequently has less endurance than the phlegmatic, rather lazy individual. Furthermore, qualifications indicative of physical energy are already covered by devotion to duty and by industry, therefore, this double item should be replaced by "Endurance."

The majority of line officers are graduates of the Naval Academy, nearly all staff officers are college graduates, and all other officers have been commissioned or given warrants after examination, so that in the matter of education there is not enough difference between officers of the same grade to make this item of material value in a report of fitness. On the other hand tact is a quality of wide variations and its possession in a high degree is of very great value to an offi-

cer; therefore, it would be advantageous to have an estimate of this quality entered on an officer's fitness report.

Would not the following changes in the form and the Regulations produce reports that are more truly indicative of the qualifications of the officer personnel?

(a) Insert a new item in the part made out by the officer reported on:

4. During the period covered by this report I have read the following professional books

---

(b) Omit from the form:

A mark below average or inferior will be considered unfavorable.

(c) Change that part of Navy Regulations, Article 137 (7), which reads:

. . . . Whenever any portion of the report made by the reporting senior is in any sense unfavorable, the reason shall be clearly stated under the head of 'Remarks' and the entire report shall be referred to the officer reported on for his statement with regard to the unfavorable portion, and the report and statement shall be returned without delay to the reporting senior. The reporting senior will forward the statement and fitness report to the Bureau of Navigation by indorsement. If the officer reported upon does not desire to make a statement, he shall so state in writing . . . .

to read:

. . . . Before forwarding the report it shall be referred to the officer reported on for such comment as he may desire to make on any portion of the report which he considers unfavorable or unjust . . . .

(d) In the table of qualifications make the following changes:

Substitute "Tact" for "Education"
Substitute "Smartness" for "Justice"
Substitute "Decisiveness" for "Patience"
Substitute "Endurance" for "Physical energy and endurance"

(e) Over the space set aside for remarks by seniors print in bold face type:

Any report which mentions only the good qualities of an officer is of no value to the Department.

Print in small type:

. . . . The reporting senior shall indicate hereon whether or not in his opinion the officer reported on has done an adequate amount of reading, having due regard for the demands of his actual duties.

(f) On the reverse side of the form reduce the space under item 13, and at the bottom of the form leave a space for the statement of the officer reported on, and a space for his signature as evidence that he has seen the completed report. Print above this space:

. . . . COMMENT ON REPORT

To be complete this report must be submitted to the officer reported on and signed by him even if he has no comment to make . . . .

THE HORIZONTAL ANGLE METHOD OF FINDING THE LOCAL SIDEREAL TIME

By John G. Kellar

IN CONNECTION with the measurement of azimuth for the purpose of orienting triangulation, using an ordinary 10" repeating theodolite, on several occasions within recent years, in cloudy weather, the writer has found it expedient to employ a method of time determination that requires only two bright stars seen for a brief interval of time,—a method that may for convenience be called the *horizontal angle method* of finding the local sidereal time. In the briefest terms the steps of this method are as follows:

1.—Point on a north star, mark the time, and read the plate.

2.—Point on a south star, mark the time, and read the plate. The difference of the readings is the *measured horizontal angle.*

3.—Assume a clock correction on L. S. T., and compute the difference of the azimuths of the stars. This is the *first computed angle.* If it is too small as compared with the measured angle, the clock, as corrected, is slow. If it is too great, the clock, as corrected, is fast.

4.—Assume a second clock correction and obtain a *second computed angle,* which should nearly agree with the measured angle.

5.—From the two computed angles and the measured angle lying (preferably) between them and near the second computed angle, corresponding, respectively, to the first assumed, second assumed, and actual clock corrections, find the actual clock correction by interpolation.

In Example 1, which follows, there are four such determinations of the clock correction. The first two, in the first time set, are assumed to differ in consequence of the inclination of the horizontal axis of the instrument, which is reversed between the pointing on the south star and the second pointing

on the north star. This mean gives the clock correction at the mean epoch of the three pointings from which the two measured angles are obtained. Similarly, in the second time set, the mean of the two clock corrections gives the clock correction at the second mean epoch. The difference between the mean epochs, and the mean clock corrections, furnish data for rating the

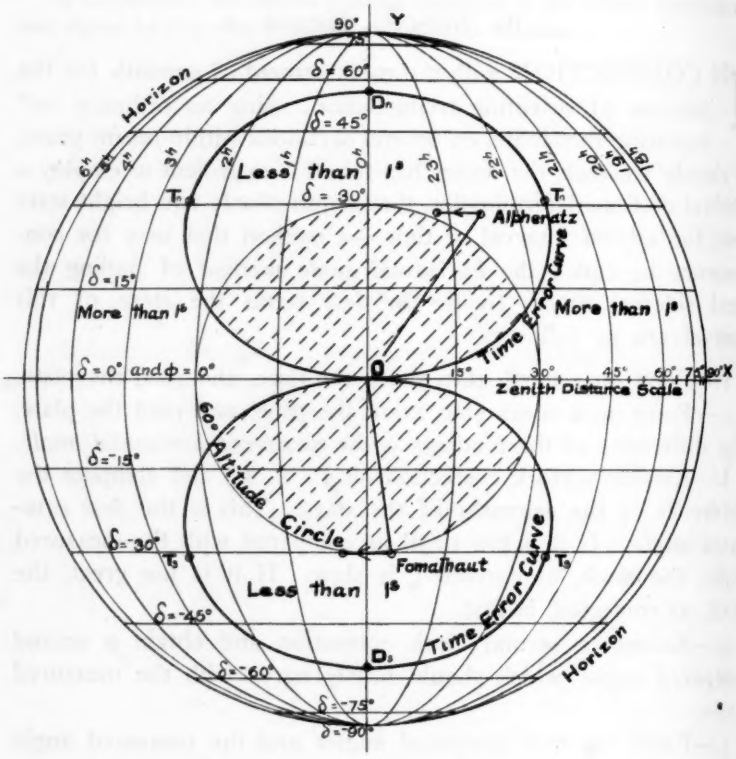


FIG. 1. LATITUDE 0

clock. It will be noted, also, that the angle observations furnish approximate data for computing the rate of change of the measured angle, by means of which a value of the clock correction very near the actual clock correction sought may be obtained, to be used as the second assumed clock correction.

In Example 2, not an actual case but devised to accompany Figure 1, the additional feature of the use of a mean time watch

is treated by assuming that the watch is losing ten seconds per hour on sidereal time and correcting all the mean time intervals accordingly before computing the azimuths.

In Example 1, the horizontal angle is observed between a slow-moving north star and a fast-moving south star, both increasing in azimuth. As will be developed theoretically later, the time error in this case is forty-five-hundredths of a second per ten seconds of angle error. In Example 2, graphically illustrated in Figure 1, the horizontal angle is observed between two stars, both of which have a rapid motion, and in opposite senses as regards azimuths, so that both contribute to the rapidity of change of the horizontal angle used to determine time. In this case the time error per ten seconds of angle error is twenty-one-hundredths of a second.

EXAMPLE 1.—July 22, 1923, at Punta Cartas, Cuba, latitude 22° 10′ N. Watch regulated to the sidereal rate, nearly, and set to the approximate local sidereal time. Theodolite with least count of ten seconds. Cloudy, few stars visible during the period of observations, thirty minutes.

OBSERVATIONS, TIME AND AZIMUTH

Polaris sub-pole; Antares near culmination, altitude about 41°.
Polaris, 2.1, $1^h\ 33^m\ 59^s.7, +88°\ 53'\ 19.''4$, $\cos\phi\tan\delta = +47.7418$.
Antares, 1.2, $16^h\ 24^m\ 43^s.8, -26°\ 15'\ 43.''4$, $\cos\phi\tan\delta = -0.45694$.

First Time and Azimuth Set			Second Time Set		
Objects	Watch	Pointings	Objects	Watch	Pointings
Mark	.....	359° 59′ 50.0″	.....	.....	.....
Polaris	$15^h\ 42^m\ 40^s$	18° 11′ 12.5″	Polaris	$16^h\ 19^m\ 27^s$	359° 59′ 47.5″
Antares	$15^h\ 56^m\ 14^s$	189° 09′ 12.5″	Antares	$16^h\ 20^m\ 36^s$	178° 05′47.5″
Polaris	$16^h\ 02^m\ 52^s$	198° 13′ 55.0″	Polaris	$16^h\ 22^m\ 32^s$	180° 00′ 02.5″
Mean epoch	$15^h\ 57^m\ 15^s$	.....	Mean epoch	$16^h\ 20^m\ 52^s$	.....

COMPUTATIONS (abridged)

Time:	First Time Set		Second Time Set	
1st Assumptions	Polaris	Antares	Polaris	Antares
	1. Watch correct, rate 0		1. Watch 24^s slow, rate 0	
L. S. times	15^h 52^m 40^s	15^h 56^m 14^s	16^h 19^m 51^s	16^h 21^m 00^s
Hour angles	14^h 18^m 40.3^s	−0^h 28^m 29.8^s	14^h 45^m 51.3^s	−0^h 03^m 43.8^s
Azimuths	0° 40′ 41.6″	171° 30′ 54.1″	0° 47′ 23.7″	178° 52′ 36.4″
L. S. times	16^h 02^m 52^s	.....	16^h 22^m 56^s	.....
Hour angles	14^h 28^m 52.3^s	.....	14^h 48^m 56.3^s	.....
Azimuths	0° 43′ 16.7″	.....	0° 48′ 07.0″	.....
1st computed angles	170° 50′ 12.5″ and 170° 47′ 37.4″		178° 05′ 32.7″ and 178° 04′ 49.4″	
Measured angles	170° 58′ 00.0″ and 170° 55′ 17.5″		178° 06′ 00.0″ and 178° 05′ 45.0″	
Differences	467.5″	460.1″	27.3″	55.6″
Rate of change of measured angle	About 18′ per minute, between 15^h 56^m and 16^h 20.^{m} Assume watch 27^s slow.		Differences about $\frac{1}{16}$ of former differences. Assume an additional 2.^{s}	
2d Assumptions	2. Watch 27^s slow, rate 0		2. Watch 26^s slow, rate 0	
L. S. times	15^h 53^m 07^s	15^h 56^m 41^s	16^h 19^m 53^s	16^h 21^m 02^s
Hour angles	14^h 19^m 07.3^s	−0^h 28^m 02.8^s	14^h 45^m 53.3^s	−0^h 03^m 41.8^s
Azimuths	0° 40′ 48.5″	171° 38′ 50.0″	0° 47′ 24.2″	178° 53′ 32.6″
L. S. times	16^h 03^m 19^s	.....	16^h 22^m 58^s	.....
Hour angles	14^h 29^m 19.3^s	.....	14^h 48^m 56.3^s	.....
Azimuths	0° 43′ 23.4″	.....	0° 48′ 00.8″	.....
2d computed angles	170° 58′ 01.5″ and 170° 55′ 26.6″		178° 06′ 08.4″ and 178° 05′ 31.8″	
Measured angles	170° 58′ 00.0″ and 170° 55′ 17.5″		178° 06′ 00.0″ and 178° 05′ 45.0″	
Differences	1.5″	9.1″	8.4″	13.2″
Interpolations:	27^s − $\frac{1\cdot5}{46\,9\cdot0}$ of 27^s = 26.91^s		26^s − $\frac{8\cdot4}{35\cdot7}$ of 2^s = 25.63^s	
	27^s − $\frac{9\cdot1}{46\,9\cdot2}$ of 27^s = 26.50^s		26^s + $\frac{13\cdot2}{32\cdot4}$ of 2^s = 26.41	
Results of sets:	Watch 26.7^s slow at mean ep. Rate, 0.03^s per min., gaining.		Watch 26.0^s slow at mean ep.	

Azimuth: At W. T. 15^h 52^m 40,^{s} L. S. T. 15^h 53^m 06.8,^{s} hour angle of Polaris was 14^h 19^m 07.1^s = 214° 46′ 46.5″ and angle from Mark to Polaris was 18° 11′ 22.5.″ Azimuth of Polaris = 0° 40′ 48.6″. Formula: cot A = -csc$t$ (cosϕtanδ − sinϕcos$t$). Azimuth of Mark = 342° 29′ 26.1″.

EXAMPLE 2.—Near Lopez, Africa, latitude 0°, longitude 10° E., approximately.

Watch keeping L. M. T., nearly, error and rate unknown. Rate assumed to be 10^s per hour on S. T., losing. Nov. 1, 1922, 8 P. M. by watch assumed to be roughly 22^h 38^m, L. S. T. Accordingly set watch forward 2^h 38^m.

Theodolite reading to 10″, not fitted with eye-piece for zenith stars.

Formula, for latitude 0°, tan A = −sin t cot δ

Time set, both before and after azimuth set: (See Fig. 1)

α Piscis Aus. (Fomalhaut)	1.3,	$22^h\ 53^m\ 23^s.74$,	$-30°\ 01'\ 54''.86$
α Andromedae (Alpheratz)	2.2,	0 04 25 .04,	−28 40 02 .51

Azimuth set:

β Octantis	4.3,	$22^h\ 38^m\ 15^s.84$,	$-81°\ 47'\ 26''.43$
γ Cephei	3.4,	23 36 16 .65,	−77 12 21 .41

OBSERVATIONS (summarized)

First Time Set			Second Time Set		
Star	Watch	A-Vernier	Star	Watch	A-Vernier
FO	$22^h\ 37^m\ 00^s$	0° 00′ 00″,D	FO	$23^h\ 14^m\ 00^s$	0° 00′ 00″,D
AL	$38^m\ 00^s$	223° 02′ 30″,D	AL	$14^m\ 40^s$	194° 53′ 50″,D
FO	$39^m\ 00^s$	180° 50′ 50″,R	FO	$15^m\ 20^s$	180° 33′ 50″,R
	Mean angle,	222° 37′ 05″		Mean angle,	194° 36′ 55″

Azimuth Set

Mark	.....	Zero, A, B.	Mark	.....	Zero, A, B.
β	$22^h\ 48^m\ 30^s$	74° 40′ 09.5″	γ	$23^h\ 02^m\ 30^s$	256° 27′ 34.2″

Remarks: 6-time angles, 3D, 3R. Pointings 1^m apart.

COMPUTATIONS

	First Time Set		Second Time Set	
	Fomalhaut	Alpheratz	Fomalhaut	Alpheratz
1st assumption:	Watch correct at W. T. $22^h\ 38^m$		Watch $2^m\ 45.30^s$ fast	
L. S. T., mean epoch	$22^h\ 38^m\ 00.00^s$	$22^h\ 38^m\ 00.00^s$	$23^h\ 11^m\ 54.70^s$	$23^h\ 11^m\ 54.70^s$
H. A.	$-0^h\ 15^m\ 23.74^s$	$-1^h\ 26^m\ 25.04^s$	$+0^h\ 18^m\ 30.96^s$	$-0^h\ 52^m\ 30.34^s$
−sin t	8.826,8892	9.566,0777	8.906,8920n	9.356,2178
cot δ	0.238,0023n	0.262,2160	0.238,0023n	0.262,2160
tan A	9.064,8915n	9.828,2937	9.144,8943	9.618,4338
A	173° 22′ 36.11″	33° 57′ 27.30″	187° 56′ 50.25″	22° 33′ 23.29″
1st computed angles		220° 34′ 51.19″		194° 36′ 33.04″
2d assumption:	Watch 3^m fast at W T. 22h 38^m		Watch $2^m\ 46.30^s$ fast	
L. S. T., mean epoch	$22^h\ 35^m\ 00.00^s$	$22^h\ 35^m\ 00.00^s$	$23^h\ 11^m\ 53.70^s$	$23^h\ 11^m\ 53.70^s$
H. A.	$-0^h\ 18^m\ 23.74^s$	$-1^h\ 29^m\ 25.04^s$	$+0^h\ 18^m\ 29.96^s$	$-0^h\ 52^m\ 31.34^s$
−sin t	8.904,0665	9.580,1644	8.906,5017n	9.356,3532
cot δ	0.238,0023n	0.262,2160	0.238,0023n	0.262,2160
tan A	9.142,0688n	9.842,3804	9.144,5040	9.618,5692
A	172° 06′ 12.94″	34° 49′ 25.50″	187° 56′ 24.88″	22° 33′ 46.04″
2d computed angles		222° 43′ 12.56″		194° 37′ 21.16″
Measured angles		222° 37′ 05.00″		194° 36′ 55.00″

Results: At W. T. $22^h\ 38^m$, W. is $2^m\ 51.41^s$ fast. At W. T. $23^h 14^m\ 40^s$, W. is $2^m\ 45.76^s$ fast.

Final result: At W. T. $23^h\ 14^m\ 40^s$ W. is $2^m\ 45.76^s$ fast on L. S. T., losing 9.24^s per hour.

In each time set the position of the measured angle between the two computed angles, which depend upon assumed times, gives data for interpolating the true mean epoch between the two assumed mean epochs.

The second assumption in each set is obtained from data resulting from the measured motion of the first star between the first and last pointings.

In simplicity, expediency, and availability, the horizontal angle method is superior to the standard meridian transit method, in which the clock correction is obtained directly by comparing the face of the clock with the right ascensions of stars as they cross the meridian; but it does not afford the wonderful precision of the latter, which deals with hundredths of a second where the proposed method is concerned with tenths of a second. However, since in azimuth observations time, or hour angle, is not the final product, but only an argument, having but slight effect upon the final product, azimuth, the lower degree of precision illustrated in the preceding examples may perhaps suffice. Table 1 shows the small effect upon azimuth of an error of 1^s in hour angle for four northern circumpolars at culmination, when the rate of change of azimuth is a maximum.

NOTE: Lest Table 1 should lead one to infer that times of culmination are to be avoided, it should be noted that these are the times when errors due to uncertainty in latitude enter with the minimum effect, whereas at elongations they enter with maximum effect.

TABLE 1—MAXIMUM AZIMUTH ERRORS PER ONE SECOND OF TIME ERROR

Circumpolars at Culmination	Declination 1931	5°	15°	25°	35°	45°	55°	65°
		North Latitude						
α Ursae Minoris	88° 56′ 01″	0.28″	0.29″	0.31″	0.34″	0.40″	0.50″	0.69″
51 H. Cephei	87° 09′ 35″	0.75″	0.77″	0.84″	0.94″	1.11″	1.40″	1.97″
39 H. Cephei	86° 55′ 37″	0.81″	0.85″	0.91″	1.02″	1.20″	1.52″	2.15″
δ Ursae Minoris	86° 36′ 47″	0.90″	0.93″	1.01″	1.13″	1.33″	1.69″	2.41″

EXAMPLE 3.—In latitude 22° 30′ N. L. S. T. 18^h, an observer points successively upon the mark, δ Urs. Min. near culmination, Capella moving westward at the rate of 9″.15 per second, and Rigel moving westward at the rate of 14″.85 per second, obtaining the horizontal angle between the last two stars within 10″. How great will be the resulting time error and azimuth error? (See 10th time pair in Table 2.)

SOLUTION: At their combined rates, Capella and Rigel pass through 10″ in $\frac{10}{24}$ seconds, or $0^s.42$. By Table 1, the resulting azimuth error for δ Urs. Min. is 0″.99 x 0.42, or 0″.42.

Obviously in the selection of stars for determining the clock correction by the horizontal angle method, the controlling element is the rate of change of azimuth per unit of time. Let us denote this ratio by the derivative

$$\frac{1}{r}=\frac{dA}{dt}=\frac{\text{increase or decrease of azimuth}}{\text{increase of hour angle}}$$

and proceed to find between what limits of hour angle and declination a time star will move in azimuth at a rate sufficient to determine a clock correction within 1^s when the difference between the azimuths of a fixed point and the star are measured within $10''$ of its true value.

The azimuth of a star, clockwise from the earth, is expressed by

$$\text{Tan } A = -\csc t\ (\cos\phi\tan\delta-\sin\phi\cos t). \tag{1}$$

Differentiating with respect to hour angle,

$$\frac{dA}{dt}=\frac{1}{r}=\frac{\cos\phi\tan\delta\cos t+\sin\phi}{(\cos\phi\tan\delta-\sin\phi\cos t)^2+\sin^2 t} \tag{2}$$

Solving a quadratic for the expression $(\cos\phi\tan\delta-\sin\phi\cos t)$,

$$\cos\phi\tan\delta-\sin\phi\cos t=-\tfrac{1}{2}r\cos t\pm\sqrt{\cos^2 t(1-r\sin\phi+\tfrac{1}{4}r^2)-(1-r\sin\phi)}, \tag{3}$$

which is the general equation of the *Time Error Curve*. In this equation, t and δ are the variables, φ is known, and r is an arbitrary constant.

Equating the radical to zero and solving for $\cos t$,

$$\cos t=\pm\sqrt{\frac{1-r\sin\phi}{1-r\sin\phi+\frac{1}{4}r^2}}, \tag{4}$$

which indicates between what hour angles, 0^h-t and 0^h+t, or 12^h-t and 12^h+t, according to the sign of the radical, an observer in latitude φ may, by measuring the horizontal angle from a point of known azimuth to a star, determine the hour angle t, and therefore the L. S. T., with an error not greater than r times the error made in measuring the angle.

The corresponding declination limits may be obtained by dropping the radical in (3) and solving for $\tan\delta$.

$$\tan\delta=\cos t\ \sec\phi\ (\sin\phi-\tfrac{1}{2}r) \tag{5}$$

Equations (4) and (5) determine eight points of the curve, four of which are illustrated in Fig. 1 as T_n and T_s. The other four, below the horizon, are projected coincidentally.

For stars on the meridian, place $t = 0^h$ or 12^h in (2).

Then, $$\tan\delta = \sec\phi(\sin\phi - r) \qquad (6)$$

from which eight points, D, O, and their counterparts, are obtained. Additional points may be computed from (3) by assigning values to t and solving for δ.

In azimuth work, from the nature of the case, there is no fixed point of known azimuth from which to measure the horizontal angle to a time star. For the fixed point, however, we may substitute another time star, and so improve the situation by selecting it with a view to causing the difference of azimuths to increase at a more rapid rate. For during any small interval of time, as t, it may be assumed that the time error, Δt, resulting from the angle error, $\Delta(A_2 - A_1)$, is proportional to the latter; that is, that

$$\frac{\Delta\,(A_2 - A_1)}{\Delta t} = \frac{d(A_2 - A_1)}{dt} = \frac{dA_2}{dt} - \frac{dA_1}{dt} = \frac{1}{r_1} - \frac{1}{r_2}, \qquad (7)$$

By substituting in (2) the particular co-ordinates of two stars for the general ones, and subtracting, the difference of ratios in (7), and therefore the ratio of error of angular measurement to error of time determination, may be found. The error of time determination, then, may be expressed by

$$\Delta t = \frac{\Delta\,(A_2 - A_1)}{\frac{1}{r_2} - \frac{1}{r_1}}; \qquad \text{that is,} \qquad (8)$$

The error in the determination of time from an observed difference of azimuths of two stars is equal to the angle error divided by the difference of the rates of change of azimuth with hour angle for the two stars.

It is sought to minimize the error of time determination by pairing stars for which the azimuth-hour angle ratios in the denominator of (8) will be of opposite sign and as large as possible numerically; or when but one fast star can be obtained, by pairing with it a star nearly stationary, or possibly even moving in wrong direction, as in Example 1, for instance, where Polaris is used sub-pole. The signs of the ratio $1 : r$ are as follows:

For stars north of the zenith and above pole, negative; below pole, positive.

For stars south of the zenith, above pole in north latitudes, positive.

EXAMPLE 4.—What is the degree of precision of time determination in Example 2 per 10″ of error in angle measurement at the second mean epoch?

By (2) and (8), $\Delta t = \dfrac{\Delta(A_2 - A_1)}{1.691 + 1.512} = \dfrac{10''}{3.203} = 3.''12 = 0.^s21.$

To derive the special form of time error curve shown in the figures, it has been assumed that $\Delta t = 1^s$ and $\Delta(A_2 - A_1) = 10'' = \frac{2}{3}^s$; also that one star of the pair is stationary, contributing nothing in the denominator of (8) toward minimizing Δt. Substituting and solving for the r of the remaining star, dropping subscripts,

$$r = \pm 1.5,$$

the signs indicating whether the azimuth is an increasing or a decreasing function of the hour angle, which is always increasing. Substituting in (3),

$$\cos\phi\tan\delta = \cos t\,(\sin\phi \mp .75) \pm \sqrt{.5625\cos^2 t + \sin^2 t\,(\pm 1.5\sin\phi - 1)}, \quad (9)$$

which may be called the equation of the *1-second time error curve.* The sign before the radical is double whether r is positive or negative. Elsewhere the upper signs correspond to r positive and the lower to r negative. The curve has four branches, symmetrical in pairs, one pair above the horizon and the other below, tangent externally when $\sin\varphi < \frac{2}{3}$, internally when $\sin\varphi > \frac{2}{3}$, dividing when $\sin\varphi = \frac{2}{3}$. The limiting equations (4) to (6) become for the maximum t,

$$\left.\begin{aligned} \cos t &= \pm\sqrt{\frac{16 \mp 24\sin\phi}{25 \mp 24\sin\phi}}, \\ \tan\delta &= \cos t\sec\phi\,(\sin\phi \mp .75), \end{aligned}\right\} \text{ hour angle limits} \ldots (10)$$

and for $t = 0^h$ or 12^h,

$$\left.\begin{aligned} \tan\delta = \sec\phi\,(\sin\phi \mp 1.5), \end{aligned}\right\} \text{ declination limits} \ldots (11)$$

The terms above-pole and below-pole, applied to the projections, in which the celestial sphere is shown as projected downward by rays perpendicular to the horizon, may well be thought of as meaning toward the pole and beyond the pole.

TABLE 2.—TIME PAIRS

L.S.T	1st Star	R. A.	Dec.	Alt.	2d Star	R. A.	Dec.	Dec.	Alt.	Ratios	Δt
					Latitude O°						
0h	α Piscis Aus.	22h 53m	−30° 02′	56°	β Pegasi	23h 00m	+27° 40′	57°	+1.73	−1.33	0.22s
8h	α² Geminorum	7h 30m	+32° 04′	57°	λ Argûs	9h 05m	−43° 07′	44°	−1.52	+0.94	0.28s
16h	γ Boötis	14h 29m	+38° 39′	46°	ε Scorpii	16h 45m	−34° 09′	54°	−0.93	+1.34	0.29s
					Latitude 7° 30′ N.						
1h	α Piscis Aus.	22h 53m	−30° 02′	49°	γ Andromedae	1h 59m	+41° 57′	53°	+1.19	−1.16	0.28s
9h	λ Argus	9h 05m	−43° 07′	39°	β Ursae Maj.	10h 57m	+56° 48′	35°	+0.94	−0.68	0.40s
17h	ε Scorpii	16h 45m	−34° 09′	48°	α Lyrae	18h 34m	+38° 43′	52°	+1.24	−0.97	0.30s
					Latitude 15° N.						
2h	β Ceti	0h 40m	−18° 25′	51°	α Persei	3h 19m	+49° 35′	52°	+1.13	−0.89	0.33s
10h	β Ursae Maj.	10h 57m	+56° 48′	47°	γ Corvi	12h 12m	−17° 07′	44°	−0.75	+0.93	0.40s
18h	α Scorpii	16h 25m	−26° 16′	43°	γ Draconis	17h 55m	+51° 30′	53°	+1.04	−1.05	0.32s
					Latitude 22° 30′ N.						
3h	β Orionis	5h 11m	− 8° 17′	46°	α Aurigae	5h 11m	+45° 55′	55°	+0.99	−0.61	0.42s
11h	α Hydrae	9h 24m	− 8° 19′	51°	β Ursae Maj.	10h 57m	+56° 48′	56°	+1.26	−0.97	0.30s
19h	γ Draconis	17h 55m	+51° 30′	58°	σ Sagittarii	18h 50m	−26° 24′	44°	−1.03	+1.19	0.30s
					Latitude 30° N.						
14h	Polaris	1h 33m	+88° 53′	31°	β Orionis	5h 11m	− 8° 17′	48°	−0.00	+1.81	0.37s
22h	α Ursae Maj.	10h 59m	+62° 10′	56°	γ Virginis	12h 38m	− 1° 01′	58°	−0.24	+1.80	0.33s
0h	α Ophiuchi	17h 31m	+12° 37′	51°	α Cephei	21h 17m	+62° 15′	55°	+0.89	−0.71	0.42s

0^h	α Ophiuchi	$17^h\ 31^m$	+12° 37′	51°	α Cephei	$21^h\ 17^m$	+62° 15′	55°	+0.89	−0.71	0.42ˢ
					Latitude 37° 30′ N.						
5^h	Polaris	$1^h\ 33^m$	+88° 53′	38°	ε Orionis	$5^h\ 32^m$	− 1° 15′	51°	−0.02	+1.55	0.42ˢ
13^h	γ Virginis	$12^h\ 38^m$	− 1° 01′	51°	β Ursae Min.	$14^h\ 51^m$	+74° 28′	51°	+1.66	−0.27	0.35ˢ
21^h	ε Draconis	$19^h\ 48^m$	+70° 04′	59°	α Aquilae	$19^h\ 47^m$	+ 8° 40′	57°	−0.55	+1.60	0.31ˢ
					Latitude 45° N.						
6^h	Polaris	$1^h\ 33^m$	+88° 53′	45°	ε Orionis	$5^h\ 32^m$	− 1° 15′	43°	−0.01	+1.36	0.49ˢ
6^h	η Ursae Maj.	$9^h\ 25^m$	+63° 25′	56°	α Orionis	$5^h\ 51^m$	+ 7° 24′	53°	−0.11	+1.62	0.33ˢ
14^h	Polaris*	$1^h\ 33^m$	+88° 53′	44°	α Virginis	$13^h\ 21^m$	−10° 45′	34°	+0.03	+1.17	0.58ˢ
14^h	β Ursae Min.	$14^h\ 51^m$	+74° 28′	60°	α Serpentis	$15^h\ 40^m$	+ 6° 40′	46°	−0.51	+1.29	0.37ˢ
22^h	Polaris	$1^h\ 33^m$	+88° 53′	46°	α Aquilae	$19^h\ 47^m$	+ 8° 40′	44°	−0.02	+1.16	0.57ˢ
22^h	γ Cephei	$23^h\ 36^m$	+77° 12′	56°	ε Pegasi	$21^h\ 40^m$	+ 9° 31′	54°	−0.34	+1.68	0.33ˢ
					Latitude 52° 30′ N.						
7^h	Polaris	$1^h\ 33^m$	+88° 53′	53°	γ Geminorum	$6^h\ 33^m$	+16° 28′	54°	−0.00	+1.60	0.42ˢ
7^h	δ Ursae Min.*	$17^h\ 57^m$	+86° 37′	49°	α Canis Min.	$7^h\ 35^m$	+ 5° 26′	42°	+0.09	+1.33	0.54ˢ
15^h	Polaris *	$1^h\ 33^m$	+88° 53′	52°	α Boötis	$14^h\ 12^m$	+19° 35′	56°	+0.03	+1.63	0.42ˢ
15^h	α Ursae Maj.	$10^h\ 59^m$	+62° 10′	57°	β Serpentis	$15^h\ 43^m$	+15° 40′	52°	+0.34	+1.55	0.55ˢ
23^h	Polaris	$1^h\ 33^m$	+88° 53′	53°	α Pegasi	$23^h\ 01^m$	+14° 47′	57°	−0.02	+1.58	0.42ˢ
23^h	β Ursae Min.*	$14^h\ 51^m$	+74° 28′	43°	α Pegasi	$23^h\ 01^m$	+14° 47′	57°	+0.25	+1.58	0.50ˢ
					Latitude 60° N.						
8^h	β Geminorum	$7^h\ 41^m$	+28° 13′	58°	γ Cephei	$23^h\ 36^m$	+77° 12′	51°	+1.67	+0.27	0.48ˢ
16^h	β Herculis	$16^h\ 27^m$	+21° 40′	51°	β Cephei	$21^h\ 28^m$	+70° 13′	57°	+1.49	+0.26	0.54ˢ
0^h	α Andromedae	$0^h\ 04^m$	+28° 40′	59°	Polaris	$1^h\ 33^m$	+88° 53′	61°	+1.15	−0.04	0.56ˢ
0^h	α Andromedae	$0^h\ 04^m$	+28° 40′	59°	δ Ursae Min.	$17^h\ 57^m$	+86° 37′	60°	+1.15	+0.01	0.58ˢ

* Sub pole to gain an advantage in altitude.

Table 2 illustrates typical time pairs for various latitudes and hours of observing. The column Δt shows the errors in the determination of L. S. T. resulting from an error of 10″ in measuring the difference of azimuths of the stars of each pair.

Figures 1 to 5 are orthographic projections of the celestial sphere upon the plane of the horizon, and therefore all ob-

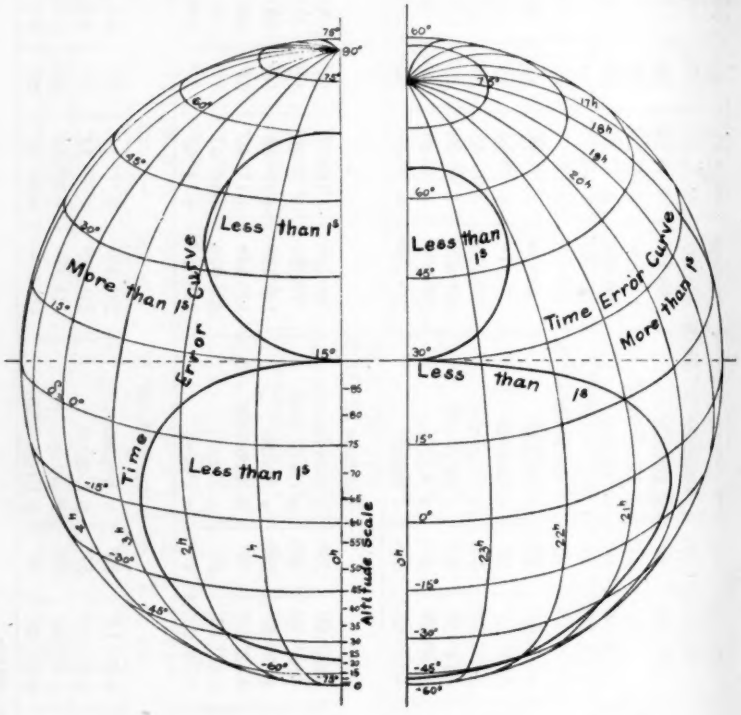


FIG. 2. LATITUDE 15°N. FIG. 3. LATITUDE 30°N.

jects shown on them appear in their true directions from *O*, the position of the observer. The computation and drawing of the projections is too laborious, however, for one who desires to select a suitable pair of time stars for a proposed azimuth observation; and therefore Table 3 has been prepared to afford a short cut. Figure 6 shows how the table may be used to avoid computation and how cross-section paper may be used instead of a projection. For after plotting the origin and the

six limiting values taken from the table, on cross-section paper, the one-second curves may be drawn roughly by hand.

The problem illustrated by Figure 6 might be stated thus: "An observer in latitude 30 degrees N. wishes to observe for azimuth at approximately 12 o'clock L. S. T. What stars are available for time pairs?" It is evident that numerous pairs are available, and also that certain ones are to be avoided.

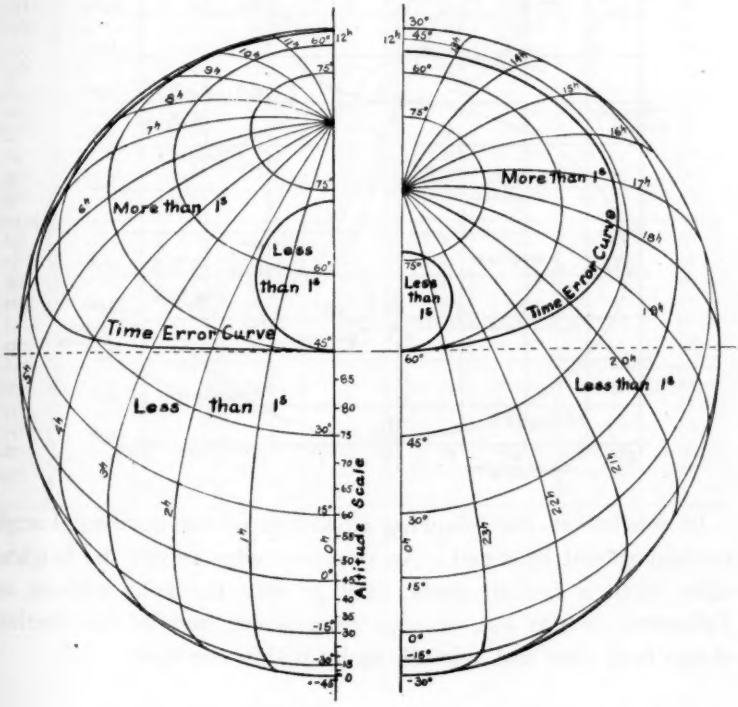
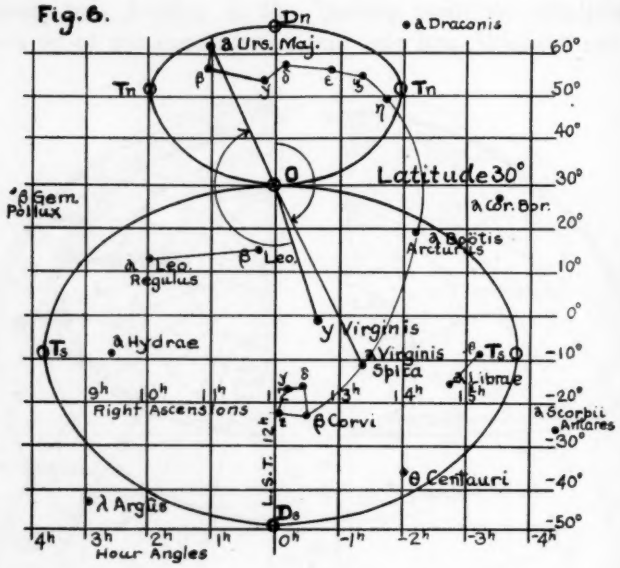


FIG. 4. LATITUDE 45°N. FIG. 5. LATITUDE 60°N.

If the observer knows but few stars, he will naturally select Polaris and some bright star in the southern one-second area, as Spica, avoiding Antares (outside the curve), Arcturus and Regulus (inside the curve, but too high), etc. If he is more familiar with the stars, he may improve the determination of time by selecting such pairs as γ Virginis and α Ursæ Majoris, β Corvi and β Ursæ Minoris, etc.

Table 2 illustrates the failure of the horizontal angle method in high latitudes when the precision desired in time determination is one-half second. For a precision of one second, however, the choice of stars, even for latitude sixty degrees is wide.



In conclusion, the following advantage of the horizontal angle method should be noted. An observer who knows the brighter stars, even a few of them, may go into the field without an Ephemeris, a star list, or a program sheet, and by this method obtain both time and azimuth easily within one hour.

TABLE 3—LIMITING VALUES, TIME ERROR CURVE

N. Lat.	South Branch				North Branch			
	Co-or. of Ts		Co-or. of Ds		Co-or. of Tn		Co-or. of Dn	
	Dec.	H. A.	Dec.	H. A.	Dec.	H. A.	Dec.	H. A.
	−	±	−		+	±	+	
0°	30° 58′	$2^h\ 27^m$	56° 19′	0^h	30° 58′	$2^h\ 27^m$	56° 19′	0^h
3°	28° 50′	$2^h\ 32^m$	55° 24′	0^h	33° 08′	$2^h\ 23^m$	57° 15′	0^h
6°	26° 41′	$2^h\ 37^m$	54° 31′	0^h	35° 11′	$2^h\ 19^m$	58° 12′	0^h
9°	24° 32′	$2^h\ 42^m$	53° 41′	0^h	37° 16′	$2^h\ 16^m$	59° 11′	0^h
12°	22° 21′	$2^h\ 48^m$	52° 53′	0^h	39° 20′	$2^h\ 13^m$	60° 12′	0^h
15°	20° 09′	$2^h\ 55^m$	52° 07′	0^h	41° 23′	$2^h\ 10^m$	61° 14′	0^h
18°	17° 57′	$3^h\ 03^m$	51° 23′	0^h	43° 25′	$2^h\ 07^m$	62° 16′	0^h
21°	15° 44′	$3^h\ 11^m$	50° 43′	0^h	45° 27′	$2^h\ 05^m$	63° 20′	0^h
24°	13° 31′	$3^h\ 21^m$	50° 07′	0^h	47° 28′	$2^h\ 02^m$	64° 24′	0^h
27°	11° 18′	$3^h\ 32^m$	49° 35′	0^h	49° 28′	$2^h\ 00^m$	65° 29′	0^h
30°	9° 05′	$3^h\ 45^m$	49° 06′	0^h	51° 27′	$1^h\ 58^m$	66° 35′	0^h
33°	6° 55′	$4^h\ 01^m$	48° 43′	0^h	53° 27′	$1^h\ 56^m$	67° 42′	0^h
36°	4° 54′	$4^h\ 21^m$	48° 26′	0^h	55° 25′	$1^h\ 55^m$	68° 49′	0^h
39°	3° 03′	$4^h\ 50^m$	48° 15′	0^h	57° 23′	$1^h\ 53^m$	69° 57′	0^h
41.8°	0° 00′	$6^h\ 00^m$	47° 51′	0^h	59° 13′	$1^h\ 52^m$	71° 01′	0^h
42°	.....	.....	48° 11′	0^h	59° 21′	$1^h\ 52^m$	71° 05′	0^h
45°	.....	.....	48° 16′	0^h	61° 18′	$1^h\ 50^m$	72° 14′	0^h
48°	.....	.....	48° 31′	0^h	63° 14′	$1^h\ 49^m$	73° 23′	0^h
51°	.....	.....	48° 57′	0^h	65° 11′	$1^h\ 48^m$	74° 33′	0^h
54°	.....	.....	49° 37′	0^h	67° 07′	$1^h\ 47^m$	75° 43′	0^h
57°	.....	.....	50° 32′	0^h	69° 02′	$1^h\ 46^m$	76° 53′	0^h
60°	.....	.....	51° 44′	0^h	70° 57′	$1^h\ 45^m$	78° 04′	0^h

SELLING TO THE SERVICE

By Commander Graham M. Adee, S. C., U. S. N.

A SCRUTINY of a few of the recent business failures has shown the inclusion on the creditors' lists of a large proportion of persons in the service. The late lamented Army and Navy Co-operative Store and the recent partial-payment-plan brokerage house in Baltimore are companies now well remembered with regret by naval officers. These are only a few of the more prominent: oil lands galore have been purchased, residence lots in Sandwich, Mass., were well circularized and sold, and even the sale of alkali lands in Nevada found plenty of willing takers,—almost without exception to the sorrow of the buyers.

An analysis of the conditions of the sales and the state of mind of the buyers which leads to so many losses might not be amiss in this connection. In the first place persons in the service are honest, and so are credulous. Their operations and line of thought in the service are conducted on a high level. So when a glib saleman comes along, drilled in the salesmanship art and fortified with a Navy roster, he finds a fruitful field to work upon. If the salesman finds a ranking officer among his first victims, the magic of that high-ranking name has its mystic charm on the lower ranking officers,—and the salesman's job is rendered easier for the salesman. The lower ranking officers have come so to revere the official acts of their superior that they come to respect his judgment in an unknown field to the same degree. Mob psychology shows that all the general herd needs is the act of a leader, and then there may be a stampede,—the herd instinct being followed by more sales. Maybe there are too many credulous buyers in the service: there are too many common swindlers to prey on the service, and the honesty of the one should combat the avarice of the other. When sales are made there is no such thing as a disinterested seller, arguments to the contrary notwithstanding. The service men are known to have regular

salaries and for the most part they are not drilled in the wiles of the money-getters.

Another reason for so many sales of unsavory financial schemes to the service is that the Navy personnel is not long in one place, it moves from port to port, and does not in all cases learn the full underlying conditions of the scheme to be sold. The officer might buy an interest in an oil well at Long Beach while he is stationed there,—but the chances are that he will not remain there long enough to keep in touch with his property. Maybe advantage is taken of his absence so that he does not reap the benefits he might. Or he might invest in something 5,000 miles off, because "distant fields are greenest." At any rate he has not the advantage of his brother in business life in one habitat who grows up with and lives in the atmosphere of his purchase.

Naval officers are thinking of things on a higher plane; their time is given to the solution of government problems; they have not time to investigate freely for their personal account. Some feel that their incomes are more or less assured, and that they may "take a chance" with a surplus, and may register a "ten-strike." It is believed that for every one who has benefited materially through striking a bonanza, there are thousands of losers.

The entire service is tremendously circularized; few mails arrive that do not contain circulars for the promotion of one scheme or another or that do not solicit subscriptions. Of all the various schemes put forward for mulcting government employees, that which has for its object the sale of stocks and bonds is the most usual. This has been brought to the point that frequently there is a salesman sent around in person, so that he may use his personality and arguments to convince the subject that "now is the time."

Officers are known to be good business risks: they will pay their bills, and this makes the officer field particularly inviting to the solicitor.

What is the remedy to avert so many casualties in the investment field for persons in the service? This is a matter which the individual must meet each in his own way,—but here are a few rules which may aid the younger officers:

1. Stick to standard lines of investments,—savings banks, real estate loan companies, insurance, and similar assured investments. The present system of allotment of pay for savings purposes may be employed to this end.

2. If stocks and bonds are sought, buy them through your bank.

3. Avoid running loans at brokers.

4. If the investor does not know what to buy, the U. S. Government securities offer the safest field.

5. Avoid purchases in stock of companies which have been in operation for less than five years. This five years may give a good demonstration as to whether the company can make good.

6. Just because one cannot answer the arguments of a slick salesman is no reason why the prospect should buy. Think the matter over for a day or two, anyway.

7. Seek the advice of your bank, or other reliable disinterested party, in the matter of a prospective purchase. Brokers are not disinterested,—their money comes as a result of making a sale.

8. Remember that anything yielding more than six per cent has a danger signal. A good answer to a salesman is: "Why sell me an eight per cent investment when you can get money from banks at six per cent?"

9. Learn to say "NO."

It is possible that these suggestions, only a few of many, may make for more solace in retirement.

SMOKE SCREEN ATHLETICS

By Walter Aamold, Instructor, U. S. Naval Academy

MURMURS are about that the Navy has become godfather to a host of tramp athletes. Here and there we sense the rumblings of commanding officers who are about to wrestle with the perplexing details of an incomplete athletic organization. "Navograms" tells between quotes and stops that the service is interested, but hard pressed, by the coming Olympic Games. Finally, to add to the situation, a pensive but thoughful officer inquires, "For what is the Navy striving in athletics?" Everything in its time, for there is nothing new in the athletic situation now before the Navy. Twelve hundred years ago military men organized athletics, and they have been reaping a harvest of perplexities ever since. Frozen into the background of an early frieze, and handed down for all time, may be seen the wry face of a commanding officer of foot soldiers who attended an athletic pot match much against his will. And, engraved on six bronze statutes over the entrance of the stadium, are the significant words, "Not with money but with speed of foot and strength of body must prizes be won at Olympia."

A smooth and interesting history of athletics reaches back into the early days of civilization. It is a story interwoven with the youth, growth, strength and decay of nations. Throughout the centuries are scattered the spiciest of stories, incidents of wit, and here and there a sticky scandal. I have long wanted to give a few of these tales for the wardroom's round table, to present the old forgotten stories of boyhood, but most of all to show the order and purpose and organization of athletics as we find it in the Navy today. To enliven the occasion we will lift a few pages from Dr. McKenzie's clever writings, and here and there some translations from Socrates and Homer.

Before cigars are in order let it be understood: The Navy should strive in athletics to *equal the best examples of Olympia!*

First: the period of casual athletic competition.

Second: the period of widespread competition.

Third: the period of high standard of excellence and record breaking.

Fourth: the period of the tramp athlete.

In the early days of Greece, athletics were the rehearsals of warlike exercises of soldiers, to commemorate feast, victory or funeral. Even at the close of the World War, as if to parallel this origin, were organized the A. E. F. Games, and a little later were held the brilliant Inter-Allied Games.

In the beginning "the gymnasium of the Homeric Greeks was the field, the hill, and the shore. The courtyard or turf was their wrestling ring, and for a race a suitable stretch could be quickly cleared." In the simplicity of these surroundings no special training was undertaken unless the exercises of a warrior are to be considered. Gifts rather than rewards were the custom.

In the second period, conditions became almost ideal, and the festivals of Olympia were organized. Other Greek states followed by example and games were developed at Delphi, Nemea, Athens and the Isthmus. The Spartans eventually led, their reward being that only the victorious were offered the "right to fight in battle next to the king and defend his person." During this period all the Greek youths participated—Greece was at high-noon. At this time athletics were leagued with art. It is important to the world that such was the case. Victories were commemorated by voting statues, first of wood and then of marble. In the fourth century they became portrait statues, and the many beautiful and historic examples of friezes which come down to us, do so solely because they recorded some incident on the field. The Olympic festivals became the center of civilization. Competitors came not only from Peloponnese but from Athens, Thebes and even the faraway East. Kings and generals were quick to see—gifts of buildings were made to decorate Olympia, proclamations were issued to the multitudes, in fact here was established the "notice board of Greece." Incidentally, the complete records of winners from 776 B. C. to 217 A. D. are now valuable means of fixing events in time. The early spirit of the games is empha-

sized by the address given in general assembly: "If you have exercised yourself in a manner worthy of the Olympic festival, if you have been guilty of no slothful or ignoble act, go on with courage. You who have not so practiced go whithersoever you will." This evidences the requirements of sincerity and a clean heart in the games. The prize became a crown of wild olive cut with a golden sickle from a sacred grove. This prize was symbolic.

The third period has now come upon us and with it some evils. "Up to this time the athletes had lived a simple, natural life in the open air, eating figs, cheese, porridge and meal cakes, with meat only occasionally. The introduction of a meat diet is ascribed to Pythagoras of Samos, a trainer of boxers. The object of the meat diet was to make weight, for there was no classification in Greece of boxers and wrestlers into light and heavy weights." It was momentous in that it at once created artificial distinction between the life of the athlete and the life of the ordinary man." Socrates complains: "The runner has over-developed his legs, the boxer his arms and shoulders." Euripides adds with disgust that such an athlete is "the slave of his jaw and belly." "The generals and soldiers condemned this training because it *left no time for the practice of military exercises* and failed to produce the all-around development necessary for the useful soldier and citizen." I am now quoting from a present day article: "Is Dunn in this ship to be a log-room yeoman or is he here to play baseball? He can't do both."

It is truly startling to find our problem glowing so merrily a thousand years ago. Because he was outclassed the shepherd went back to his sheep, and likewise we suppose, the yeoman back to his logs, neither again to feel the thrill of competition, neither to hope to excel.

As a result a great many youths drifted into an untrained class, and Socrates happening upon one such chap reads him this lecture: "No citizen has a right to be an amateur in the matter of physical training. It is a part of his profession as a citizen to keep himself in good condition and ready to serve his state at a moment's notice." The Navy as well owes something to citizenship—it must develop the boy it takes from the land; he is not to be lost in log-room or galley.

Specialization brought to the clean fields of Olympia such customs as the perfidy of Astylus, who after establishing a great reputation as a runner in 75 B. C. sold out as a Syracusan to gain favor with the tyrant, Hieron. Well, for this the folks back home demolished his statue, banished him, and converted the house they had given him into a common prison. This was the first tremor. In rushed the hired fighters, wrestlers and runners of kings and noblemen. Arcadian baths were set up, the market place flourished, and the athlete sank to rubbing elbows with the huckster, the peddler, the acrobat and the juggler. While the crowds at Olympia grew the athlete was tottering on his last leg. Then fate stepped in to revive him just before the final knock-out. The war with Persia flared up. "A handful of free citizens, athletic and well-trained, defeated a horde of slaves at Marathon." There was a brief athletic renaissance, but the end was in sight, for Rome was rising into its first glory.

The downfall of Greece is not attributed to abuse of athletics—there were many reasons. Macfie says: "The Turk and mosquito together have destroyed Greece, and perhaps the mosquito has been the most destructive. Little did the Greeks know that the blood of slaves they imported swarmed with microbes that would devour their mighty civilization. Yet so it seems it was. Nemesis is a gnat." In athletics, Nemesis is abuse. Whatever may have been the cause of decay, there is evidence of a widespread physical degeneration before the end.

The athletic story of Rome is a duplicate of the tale of Greece. Following a clean beginning we find Nero at Olympia, the ringmaster in a piteous tale of degeneration. We observe that wild beasts are the athletes of the day. Starved lions are pitted in battle against well-fed Christians.

Following the Latin rise and fall came a wave of Teutonic athletics, and as time went on the system reached into the hills of the Scots. Then to England, whence it may be traced to the far stretches of the world. In every case the outline seems the same. The point back of the story of athletics is that it reflects the tone of the people. This is so evident that it need not be emphasized. The Greeks and early Romans were able to write

athletics into the world's history of the day. After a physical survey of men for the recent war, the present generation wrote something into history—*it has been inscribed that seventy per cent of our "citizen bloods" are not physically fit to wear as much as a soldier's bottom button.*

Was the Greek of the second period superior physically and in spirit to the bluejacket of today?

Do navy athletics as they stand reflect the wholesome tone of the Navy?

Is the Navy satisfied with its physical and athletic status?

The Navy recognizes the value of competition. We see a ship proudly flying the gunnery trophy, or a red E stands out somewhere in the fleet. In this competition no quarter is asked, none is given. The best gunners are not subordinated to give mediocre crews a chance.

Throughout the entire Navy officers are of one mind as far as gunnery or engineering competitions are concerned. The pennant must be won! In athletics, unfortunately, there are as many minds as there are signal numbers—one ship is active, another passive. That old question from "A to N" relating to athletics, required a different answer before different boards. Figuratively, athletics present a case of "every man for himself." It has been said that war should be the normal working pace for the service. If the Navy is too busy in peace to find time for athletics for everybody, how overworked it might be in war! It is not a question of time—neither is it a question of material or ability.

We read that "Knockout Grogan" has made a questionable name for his ship. Why should he? He's less than one-tenth of one per cent of his ship—he is a product of the Navy and under Navy control—otherwise he has no place on board ship. Without the "Murphys" and "Grogans" little would be left to the present athletic fabric afloat. Unguided "Murphy" is doing something at least. Why not back him, dress him up, and let him set a good pace—or else scrap him!

Athletics do not rest with the Murphys and Grogans, but in the unity of purpose of officers.

If all officers will agree on any policy, be it ever so simple, that then becomes the law. A jury of thirteen would sit on the

officer who inquired, "For what is the Navy striving in Gunnery?"

Let the Navy select a simple "Olympia"—then, just beyond the Southern Drill Grounds establish "All-Hands Field" for athletics. Dedicate one afternoon a week (once it was Thursday) to casual athletic competition. Try division soccer, or lacrosse between the band and galley forces. Once a year plan a week of "high doin's" at All-Hands Field.

Occasionally a connecting voice may be heard between poor gunnery and low athletics. By this is not meant that high athletic spirit actually makes high gunnery. A certain ship stood noticeably lower in gunnery than others in her division. The officers had worked with full spirit; what technical reasons were given is not known. It is a fact that her crew went to their guns in a sullen spirit, because they imagined that there had been mismanagement of their athletic funds and recreational interests. Their whispered accounts of target practice would have done credit to the "Perfidy of Astylus."

It has been said that a man who will fight for his ship will shoot for his ship. Wherever there is gunnery, we look for the gunnery spirit—which is the spirit to excel in competition. What gunnery and engineering competition is to officers, on account of their training, ship's spirit and athletic spirit is to the men, by the nature of things. It is not difficult to find a fighting navy spirit on the Navy side during the progress of an Army-Navy game. "I bet you my neck on the Navy!" would be heard if the Army led by ninety-nine. But, it is exceedingly unusual to see evidences of enthusiasm on what might happen to be a "petticoat" man-o'-war.

Perhaps it is not amiss to say that in some cases ship's athletics are old fashioned. Throughout the college and industrial world a new order has been formulated. This new idea is known by the general term of mass athletics. This year an athletic representative made a test of mass athletics aboard a normal ship of the fleet. Briefly, the experiment was a success—it reached men who had never responded before—it did not conflict with ship's routine.

Year around participation by the personnel is impracticable, even under ideal conditions. But annual games and prepara-

tion for them, along with casual competition for everyone, and mass athletics while at sea, are not only practical but necessary to the highest spirit.

The Navy is in a position to set an example of physical well-being for the entire nation, for it has the raw material, routine, medical service, and what not at its command. What is required in this branch is a more complete organization. As the Olympic Games were the ideal of Greece—let it be said that the Navy is the ideal of America.

A SUGGESTION FOR IMPROVING THE PRESENT TEST ON BOILER WATER

By Lieutenant H. E. Dow, U. S. N. R. F.

IN THE following article I have endeavored to submit a suggestion which I believe will improve the accuracy of the present test on boiler water and also give an engineer officer results which he may compare from day to day more intelligently than is possible with the results reported by present methods.

It is standard practice in the United States Navy to maintain the concentration of soluble alkaline salts in the water contained in the boilers of vessels of the Navy at not less than one-tenth of one per cent, nor more than five-tenths of one per cent of normal alkaline strength and at the same time the chlorine content of the water is kept below thirty grains per gallon in small tube water tube boilers, fifty grains per gallon in large tube water tube boilers and 100 grains per gallon in scotch boilers. The above facts are set forth as prescribed rules in the reprint of Chapter 6 of the "Manual of Engineering Instructions" issued by the Navy Department, Department of Engineering, in 1922.

Experience has proven that if boiler water is kept in the condition called for by the above instructions little or no trouble will be met with from corrosion, pitting or scale formation in either the boilers or piping connected thereto, but it has always seemed to me that the tests for keeping the water in the condition called for were made too much a matter of routine.

Possibly a reason for this is that alkalinity is reported in per cent of normal alkalinity, while chlorine is reported in grains per gallon. It is always difficult when studying two elements of a subject to be obliged to shift mentally from one unit of measure to an entirely dissimilar one, especially in

chemistry, for I imagine that with most of us our chemistry dates back to the days of our school training, and while grains per gallon gives us a perfectly definite idea of weight in solution per unit of quantity, per cent of normal alkalinity means something as perfectly indefinite.

A normal solution is one that contains one gram molecular weight of the dissolved substance divided by the hydrogen equivalent of the substance per 1,000 c. c. of solution.

The molecular weight of a substance is the weight of the smallest unit quantity of the substance which can exist by itself and retain all the properties of the original substance.

The hydrogen equivalent of a substance is the number of replaceable hydrogen atoms in one molecule or the number of hydrogen atoms with which one molecule of the substance can react.

In the case of boiler water the substance responsible for the alkalinity is largely sodium carbonate otherwise known as soda ash, the chemical formula for which is Na_2CO_3. A normal solution of sodium carbonate would then be, by definition, one gram molecular weight of Na_2CO_3 divided by its hydrogen equivalent. From Hodgman and Coolbaugh's *Handbook of Physics and Chemistry* the molecular weight of Na_2CO_3 is 106 and its hydrogen equivalent $\frac{1}{2}$ Na_2CO_3. Therefore a normal solution of sodium carbonate will contain

$$\frac{1 \times 106}{2} = 53 \text{ grams } Na_2CO_2 \text{ per 1,000 c. c. of solution.}$$

As we use the English system of weights and measures it will be necessary to change the fifty-three grams of sodium carbonate per 1,000 c. c. of normal solution to grains per gallon. From conversion tables 3.875 liters = 1 U. S. gallon and 1 gram = 15.43 grains.

Hence $15.43 \times 53 \times 3.875 = 3{,}094.56$ grains per gallon of normal solution of sodium carbonate.

According to instructions the water in naval boilers is to be maintained between one-tenth per cent and five-tenths per cent of normal alkalinity.

Hence .001 × 3,094.56 = 3.09 grains per gallon for one-tenth per cent of normal alkalinity and

.005 × 3,094.56 = 15.47 grains per gallon for five-tenths per cent of normal alkalinity.

For practical purposes these limits may be called three and fifteen grains per gallon. Therefore, if the water in the boilers is maintained between three and fifteen grains of total alkalinity, the instructions will have been fulfilled and alkalinity will have been reported, not only in the same unit of measure as cholorine, but in a unit of measure which is susceptible of more accurate determination with the means at hand on ship board than is per cent of normal alkalinity.

It is a well known principle of titration that the larger the sample titrated and the weaker the titrating solution, within reasonable limits, the larger the quantity of titrating solution will be required and consequently the less inaccuracies in measuring the titrating solution used will affect the accuracy of the results.

According to instructions the acid used in titrating for alkalinity in the present test is made by adding to thirty-two c. c. of standard nitric acid containing seventy per cent of pure acid by weight, 968 c. c. of distilled water making up 1,000 c. c. This gives a one-half normal acid solution, only one c. c. of which is required to neutralize one per cent of normal alkalinity in a fifty c. c. sample of water. It will be seen that less than one-half c. c. of acid would be required to neutralize the alkalinity of a fifty c. c. sample of water, the alkaline content of which is within the limits prescribed by instructions.

The burettes used in the Navy Standard Water Testing outfit have a capacity of fifty c. c. and are graduated in one-tenth c. c. It is manifestly impossible to draw less than one drop of solution from a burette at a time and it is seldom that a drop is less than one-tenth of a c. c. and frequently it is more than that quantity. If a drop is equal to one-tenth of one c. c. and the sample being titrated has a total alkalinity of one-tenth of one per cent of normal alkalinity an error of one drop in measuring the acid solution would cause an error of fifty per cent in the reported alkalinity, while if the sample has an alkalinity of five-tenths of

one per cent of normal alkalinity a mistake of one drop of acid would cause an error of twenty per cent in the result.

In titrating for grains per gallon of alkalinity it would be convenient to adjust the strength of the acid solution so that one c. c. of solution would neutralize one grain per gallon of total alkalinity in a 100 c. c. sample. Such an acid solution would require 2.034 grams of standard nitric acid containing seventy per cent of pure acid per 1,000 c. c. of solution. This solution could be conveniently made with sufficient accuracy for practical purposes by drawing two c. c. of acid from a burette and adding distilled water to make 1,000 c. c. of solution.

It can be readily seen that whatever the alkalinity of the sample tested a mistake of one drop or one-tenth of one c. c. in measuring the titrating acid would cause an error of only one-tenth of one grain per gallon in the alkalinity reported. Such an error is negligible.

With chlorine and alkalinity reported in the same unit it seems evident that daily or more frequent tests could be compared for increasing concentration or for any irregularities that might arise due to unevenness of steaming of several boilers or to any other cause, and that a more accurate and intelligent estimate of the condition of the water in the boilers at any time or over any recorded period might be made than is possible with the present method. Furthermore, because of its greater accuracy a test for alkalinity in grains per gallon applied to water in the reserve feed tanks will make certain that no feed water will enter the boilers in such a condition as to reduce the alkaline concentration of the water in the boilers without the previous knowledge of the engineer officer. Such a test of water in reserve feed tanks is impossible with the present method because the alkalinity of the water is too low to be measured by the one-half normal acid solution used in titrating for per cent of normal alkalinity in the Navy Standard Test.

DISCUSSION

Shall We Outgrow The Panama Canal

(See page 7, January, 1924, PROCEEDINGS)

CAPTAIN A. W. HINDS, U. S. NAVY.—I read Mr. Weems' paper with a great deal of interest and I am in agreement with him that the government should not dig another canal connecting the Atlantic and Pacific oceans until the second great ditch is needed.

Soon after the present Marine Superintendent reported for duty, in April, 1923, we began to have difficulty with the steering of some of the deep draft ships in making Canal transit. The most notable trouble makers were ore ships in the Chile-New York trade and heavily laden oil tankers. Some of these drew as much as thirty-four feet in fresh water and as the lake level goes down, near the end of the dry season, the small amount of water under their keels added to the fact that these ships handle none too well any way gave us some anxiety in their transits of the narrow waters of Gaillard Cut. In looking around for the cheapest means to increase the depth in the Cut during the dry season, we were naturally led to a study of the limitations of the Canal and the increase of traffic it may be called upon to handle in the not very distant future.

The volume of traffic through the Canal is limited by:

(a) The necessity of lock overhaul;

(b) The capacity of the locks; and

(c) The capacity of the storage area for collection of water needed in lockages.

Ordinary traffic can flow through the Canal in two streams, as ships can pass even in the narrowest part of the cut, but about once in three years the lock machinery must be thoroughly overhauled. The great valves used in handling the water must be taken out and machined and their seats removed. The lock gates must be scaled and painted and their water seals replaced. Heretofore, since the pressure of traffic did not become heavy until the early part of 1923, about four months have been allowed for lock overhaul and the work has been done during daylight hours, principally with the lock-operating and maintenance personnel.

In the future, however, the steadily increasing traffic will force the Canal authorities to work night and day at the overhaul and by doing this and carefully planning to have all material ready, a set of locks can be overhauled in about six weeks.

In order to predict the time when the Canal will reach its capacity

and when various changes will be forced upon us, it becomes necessary for one to assume the dangerous rôle of a prophet. It seems hardly safe to base anything on Panama Canal past performances, for the transits at Panama were interfered with by slides and then the great war came to entirely disarrange the normal flow of sea-borne commerce.

In order to obtain some kind of a gauge to assist in predicting the increase of traffic through the Panama Canal, the increase of passages through Suez between 1880 and 1910, when unaffected by any great war, was taken as a guide. It was believed that due to the rapid increase of population on our West Coast and to the fact that there is little coal or iron on the Pacific slope, there must be a marked increase in the shipping service between our Atlantic and Pacific coasts. It was therefore thought that a very conservative estimate would be made in saying that the increase in traffic through the Panama Canal will be as great as the increase in Suez between the years of 1880 and 1910.

We then took ships per month as an ordinate and years as abscissa, and taking as a point the average ships per month passing through the Panama Canal in the first five months of 1923, we drew through this point a line parallel to the Suez increase 1880-1910 and assumed this line would show the rate of increase of traffic at Panama. The curve gave predictions for Panama passages as follows:

Year	*Predicted Average Ships per month*
1925	430
1930	540
1935	650
1940	760
1945	880
1950	990
1955	1,100
1960	1,210
1965	1,320
1970	1,430
1975	1,540
1980	1,650

When a set of locks is under overhaul about the best the Canal can do is to put through the other twin lock thirty ships a day, and it is a very safe prediction to say that when traffic is held up the Government will be forced to come to the rescue in some way, if it is possible to do so.

An inspection of the preceding table shows we shall have thirty ships a day about 1946, so by that time we must find some way to relieve the pressure during lock overhaul. There is only one way to do this and that is by building a third system of locks paralleling the double locks already in use.

When the present Canal was built there was very little attention paid

to economy—the slogan was "Make the dirt fly," but by going a little more slowly the locks that will be needed in 1946 could be built far more cheaply than the original construction. Assuming that ten years is ample time to construct the additional locks in the most economical manner, it can be seen that they must be begun in 1936, only twelve years from now.

Water Storage Capacity

The water in Gatun Lake, eighty to eighty-seven feet above sea level, is used in three principal ways: (1) It reaches the Atlantic or Pacific through the locks when ships are locked through; (2) some of it is used for electric power production, passing into the Atlantic through the mill race at Gatun Dam; and (3) some of it evaporates.

The rainy season begins at Panama about May 1 and continues until about the fifteenth of December. During this period there is no worry over the water supply, and the lake level gradually rises until it is eighty-seven feet above the sea. During the latter part of the rainy season, when the rainfall is heaviest, some of the spillway gates at Gatun must be opened and the water allowed to escape, as otherwise it would overflow into the lock chambers and into the lock machinery operating spaces. Unfortunately, the locks were so designed that the water level in Gatun Lake cannot be increased in height to more than eighty-seven feet above the sea. Changes to increase this height one or two feet and thus add a big percentage to the storage volume do not seem practicable.

At the end of the wet season the lake is always at a height of eighty-seven feet above the sea, and at this time there is a depth of forty-seven feet in Gaillard Cut. As some deep draft vessels using the Canal draw as much as thirty-four feet, they have thirteen feet under their keels when the lake is at maximum height.

Soon after the fifteenth of December, when the dry season comes in, the lake level begins to fall, and when it has fallen about seven feet there are only forty feet of water in the Cut, and the deep draft vessels begin to behave badly, sheer over toward the banks, and sometimes hit them. Naval officers who have served on battleships know how difficult it is to maneuver them in shallow water. This same principle applies to a deep draft vessel in the Cut when the lake gets low. The matter is highly speculative, but the present Marine Superintendent would not like to see the depth of water in Gaillard Cut reduced to below forty feet.

Even when carrying forty feet of water in Gaillard Cut, its actual depth is reduced by what are called the "surges." When water is drawn into the inshore Pacific locks it must be replaced by water from Gatun Lake. The water must flow through the long, narrow Cut, and it is taken so fast that the actual depth in the Cut is reduced by about a foot and a half. It follows that with forty-foot depth in the Cut, there are practically only thirty-eight and five-tenths feet, so a thirty-four-foot draft ship has really only four and five-tenths feet of water under her keel. These ships sometimes behave so badly that the pilots refer to them as "bad actors."

There are two projects in mind for carrying a little more depth in Gaillard Cut during the dry season. The minor one of these is to build a small lock supply reservoir at the inshore Pacific lock. This would cost about a million dollars and would reduce the "surges" to an inappreciable amount and add, in effect, about a foot and a half to the depth in the Cut.

The other and more ambitious project is to add to the water storage by building a dam costing about six million dollars at Alhajuela, some thirteen miles up the Chagres River from the Canal prism.

Both these schemes will be carried out in time, but it would be a great addition to Canal efficiency to carry out these improvements at once.

According to water storage figures given by the Chief Hydrographer of the Canal Government, even when the lock supply reservoir and the Alhajuela storage dam are built, there is a water supply limit to the capacity of the Canal in ship lockages.

There is a fine morale in the Panama Canal personnel, as all hands have been educated to guard with jealousy the reputation of this big piece of engineering. In deriving the figures as to ultimate water supply, the Hydrographer was therefore very conservative. He assumed that we will again be faced with a dry season as in 1920, the longest and driest on record, and under these assumptions he calculates that when the additional water storage is provided 1,630 lockages per month can be made and still have forty feet of water in the Cut at the end of the dry season.

A glance at the table on page 249 shows that if the traffic increases at the same rate Suez traffic increased from 1880-1910 and all practicable improvements are made, we shall reach the ultimate capacity of the Panama Canal about 1979.

There should be no trouble about the wherewithal to make all the improvements noted if Congress can be induced to appropriate for Canal improvements and changes only a small portion of the money collected for tolls. The tolls are now running over two million dollars a month. If we accept the table of predicted increase in traffic and assume that the Canal Government will be run economically and the total rate not changed, the big ditch should *clear* an average of thirty-five million dollars a year between 1930-50.

Summarizing it can be seen:

1. That we need now a small storage of water near the inshore Pacific locks to prevent the temporary reduction of depth in Gaillard Cut when the locks are being filled. In addition this will prevent currents in the Cut. The cost will be something like a million dollars.

2. That we need now the additional water storage Alhajuela dam will give in order that the depth in the Cut may not be reduced too much near the end of the dry season. The cost of the dam will be something like six million dollars.

3. That by 1936 we must begin construction of a third set of locks to

parallel the other two so we may have it ready in 1946 when needed.

4. That somewhere around 1965 we must make preparations to cut another canal in some other locality in order to have it completed when the limit of water storage on the Isthmus of Panama is reached.

A Suggestion Regarding Battleship Organization

(See page 1805, November, 1923, PROCEEDINGS)

COMMANDER JOHN P. JACKSON, U. S. NAVY.—I must take issue with Lieutenant Commander Esler's proposition to make the first lieutenant subordinate to the gunnery officer. Having recently had duty as executive officer of a dreadnaught, I have had ample opportunity to view the working of the present system intimately and at close range. His article sounds plausible, and young officers prone to make changes, and not familiar with the gradual development of our present battleship organization, may easily be led to accept his views.

In the first place, what Lieutenant Commander Esler proposes is a step backward. The modern tendency in the Navy has been toward decentralization, in ships which with their complements up to this time have been ever increasing in size. It cannot be seen how the present organization is absolutely opposed to the basic principles of military control. The head of the organization is still responsible. He delegates certain duties to his subordinates, but he is responsible that they are performed, and it is up to him to see that his subordinates perform them, just as Lieutenant Commander Esler describes in his second paragraph.

Before the Spanish War there was only one line head of department—the navigator. All other line departments were concentrated in the executive officer. He was the construction, equipment and ordnance officer in one, and kept all the expenditure books for those departments. After the Spanish War, the old Engineer Corps, until then separate, was amalgamated with the line. However, the position of the old chief engineer as head of the engineer department, did not change. Then the introduction of modern gunnery into our Navy caused the creation of the ordnance officer, who later became the gunnery officer. In the meantime the duties of the executive officer on a then modern battleship became so onerous that the first lieutenant was created to relieve him of some of them, and the general storekeeping system introduced on board ship, took over the care of all supplies of whatever nature until issued for use.

The first lieutenant's job was one of maintenance, upkeep and cleanliness of the ship, while the executive officer still retained cognizance over matters pertaining to personnel. As Mr. Esler says, the executive officer as representative of the captain, is at present the co-ordinator of all departments on board ship, and the heads of departments may be regarded as his aids, amongst whom the entire work of the ship, for which he is responsible, is subdivided. The executive officer is the second in command, trained and prepared to replace the captain at any time. He is in

direct charge of the preparation of the ship and its personnel for battle, and co-ordinates all work, drills and exercises to this end. Into greater detail than this he cannot and should not be expected to go.

And yet, after the years spent in the slow evolution of the present organization, Lieutenant Commander Esler proposes to throw all the results away, and hark back to the days before the existence of the first lieutenant when the executive officer had to do it all. Even though he does not propose to abolish the first lieutenant, he advocates re-transferring some of his duties back to the executive officer (hull book, blueprints, etc.) and at the same time loads the first lieutenant with the additional duties connected with gunnery training. On a modern dreadnaught the executive officer cannot be burdened with details, and the first lieutenant's legitimate job is big enough to keep him busy all the time without being distracted by duties connected with the gunnery department.

Who could be more inappropriately charged with the responsibility for the hull book than the executive officer? He cannot be saddled with details of hull inspection, and properly perform his real job. No man can be the general manager of a great establishment, involving manual labor, brain-work, planning, accounting, record keeping, maintenance and repairs, sanitation, etc., and be a foreman in one of the shops at the same time. Can one conceive of the general manager keeping all the blueprints of such an establishment? He would have little time for anything except to issue, account for, and collect these.

I cannot see from my experience, that the dual control of the gunnery officer and the first lieutenant over the men of the deck and gun divisions, causes any friction nor that they work at cross purposes; for the reason that their control over these men is at entirely separate times. It is part of the duty of the executive officer to co-ordinate drill and work, and so far as I have been able to see, he does so. Certain distinct times are laid down in the ships routine for drills and exercises, and certain distinct times for ship's work. Under normal conditions these times do not conflict. From early "turn to" in the morning until "quarters" the men of the deck divisions belong to the first lieutenant, and he writes or assists to write the morning orders. Throughout the morning and afternoon drill periods they belong to the gunnery officer, and he makes out the drill schedule for the week, subject to the approval of the executive officer. After drill they belong again to the first lieutenant for ship's work.

There is no conflict of authority here, and I can conceive of no more simple arrangement. Mr. Esler might just as fairly complain of dual authority over the same men when the supply officer takes charge of a working party from the deck divisions to handle stores, or the gunnery officer takes charge of the men from the Supply Department at General Quarters. Each man has his station for drill and battle and his station for work and cleaning. They are under the authority of different heads of departments for each of the two forms of activity, and therefore every man on the ship may be said to be under dual control, and not those of

the deck divisions alone, under the gunnery officer and first lieutenant. To arrange otherwise would necessitate having a double complement of men for every ship, one for preparation for battle, who would do no work, and one for work who would have no battle stations.

There is, therefore, no more reason to make the first lieutenant a subordinate of the gunnery officer, than there is to make the supply officer or any other head of department who furnishes men for General Quarters. But the greatest objection to Mr. Esler's scheme is the piling upon an already overworked first lieutenant (if he does his present job properly) the additional responsibilities of gunnery training. He would require one officer to perform the duties which are at present considered (and rightly so) sufficient to fully occupy two officers,—the present first lieutenant and the assistant gunnery officer.

Abnormal times,—that is, times when the ship's routine does not apply, such as during target practice and preparation for same, when all men are turned over to the gunnery officer, and at coaling ship when all are turned over to the first lieutenant—usually take care of themselves. When they do not it is an easy matter for the executive officer to exert his co-ordinating authority to settle things. In my entire experience as executive officer, covering fifteen (15) months in an armored cruiser, and one (1) year in a dreadnaught, I cannot recall a single instance of friction between the gunnery officer and the first lieutenant regarding the use of men,—these being the two concerned in the dual control of which Mr. Esler speaks so much. On the other hand I can recall, not many, but a few instances where friction did arise between the chief engineer and the first lieutenant, and the chief engineer and the gunnery officer; the engineer department being the one department on the ship which Mr. Esler cites as a strictly military organization.

Mr. Esler thinks that by putting the first lieutenant under the gunnery officer, the latter's department would gain one experienced officer of which it is much in need, who could be used as a turret supervisor. He seems to be unaware of the fact that the dreadnaught's complement already provides for two assistants to the gunnery officer, above the rank of the gun division officers. These are the assistant gunnery officer, who is charged with the development of the secondary battery, and the chief turret officer, who is charged solely with supervision over the turrets. If the first lieutenant was charged with either of these duties and still kept his battle station in the central station, another officer would have to be provided as a spotter, so nothing would be gained. At present the chief turret officer, if qualified, usually spots for the main battery. The net result would therefore be the loss of one valuable head of department, with no gain to the Gunnery Department and the saddling of the first lieutenant with so much additional work in connection with gunnery training, that he could not pay the proper attention to the work for which he was created (maintenance, upkeep, and cleanliness of the ship.)

In regard to putting the artificers in the engineer division and making the senior engineer officer the construction officer of the ship, does not this merely push along the dual control system of which Mr. Esler complains and put it out of the ship instead of within it? There are then two bureaus of the Navy Department having control over the same ship's head of department.

To divide the ship's allotment as he proposes, amongst the various departments of the ship, would be a very difficult matter for any expert naval constructor not attached to the ship to do fairly and in proper proportion to actual needs. All ships, even sister ships, differ in internal and sometimes in external arrangement, and often two similar ships' cleaning bills differ very much in the assignment of spaces to different departments. It would be a practical impossibility for an outsider to estimate just the proportion of paint and cleaning gear each department should be allowed, as of course, he does not know how many square feet of surface each has been assigned for cleaning on any particular ship. Better continue to have the first lieutenant control the C. and R. allotment, and in case of dispute, trust to the executive officer to settle the matter. In other words, let the ship run its own affairs with as little interference as possible from the bureaus of the department, and no rigid instruction from the latter as to where each part of the allowance is to be expended.

Ships do not get dirty and deteriorate uniformly each quarter. One quarter there may be an unusual amount of handling of ordnance stores, requiring more cleaning gear and paint for that department to get back into shape. The next quarter's work may include the scaling of the fireroom bilges, or rainy weather may necessitate more scraping and red-leading of rust spots. I can conceive of nothing more exasperating than to run short of the paint allotted to one part of the ship and not be able to use that allotted to another part, no matter how much excess there was. Let well enough alone and don't bind ourselves up with any more stringent regulations regarding the expenditure of stores.

To summarize, the following principles of organization appear to me to be axiomatic and our present battleship organization to conform to them:

1. Don't load the general manager of a big establishment, in this case the executive officer, with burdensome details (such as hull books and blueprints).

2. Let each department of a ship handle its own affairs, for which it was created, without any amalgamation of departments. In other words decentralize instead of centralizing work.

3. Have the necessary number of ships departments to accomplish this, each being co-equal with the others.

4. Let the executive officer have co-ordinating authority over all departments (which he now has) as to drills, exercises and work, and the preparation of the ship in general for battle.

5. Make the executive officer responsible to the captain (as he now is) for the proper functioning of each department, and for the getting of results.

In my opinion these axioms are attained by our present battleship organization and I cannot concur in any proposal to change it.

The two points upon which Mr. Esler bases his entire objection to the present system of organization seem to be the dual control of the gunnery officer and the first lieutenant over the deck divisions, and the fact that the regulations make the first lieutenant co-responsible with other heads of departments as to the cleanliness of their parts of the ship. As to the first point, I have attempted to show that in practice no friction really exists. The bug-bear of dual control is more imaginary then real. As to the second point, would not a small change in the regulations clear up the whole matter, and avoid disrupting the entire present organization, as he proposes.

The first lieutenant should not be responsible for the cleanliness and upkeep of any parts of the ship which come under the cognizance of other heads of departments, such as galleys, bakery, storerooms, turrets, magazines, sick bay, dispensary, charthouse, steering engine room, etc. In any case putting the first lieutenant under the gunnery officer would not solve this question of double cognizance as regards the other heads of departments, and this is not the proper solution.

Although it is true by regulations the first lieutenant is responsible for "the ship as a whole and all parts thereof," in practice he is not so held; and the heads of departments answer to the captain at inspection, or to the executive, for the condition of parts of the ship under their cognizance. In practice therefore, there is no question of dual control, and the regulations should certainly be changed to conform to practice. Article 1041 (1) should be corrected accordingly.

Regarding Battleship Organization

(See page 1805, November, 1923, PROCEEDINGS)

LIEUTENANT COMMANDER FRANK LUCKEL, U. S. NAVY.—Lieutenant Commander Esler's article is based upon sound military principles. There are, however, certain features which merit discussion.

Objection is made to the present organization on account of the first lieutenant and the other heads of departments being jointly responsible for the material condition of each individual department, and, on account of the deck division officers being responsible to both the gunnery officer and the first lieutenant.

The regulations specify that the first lieutenant "shall be responsible for the cleanliness and good condition of all compartments—except those specified as coming under the engineer officer." There is no divided responsibility here. The first lieutenant is responsible to the captain, and the head of department is responsible to the first lieutenant. Insofar as cleanliness and upkeep are concerned, they appear to be responsible for their compartments to exactly the same extent as are the deck division officers. While the first lieutenant is relieved of responsibility for compartments, etc., within the engineer's department, he has the necessary authority

over even the engineer officer whenever the ship as a whole is involved. To quote from the regulations, "The first lieutenant shall be responsible for the cleanliness, good order, efficiency and neat and trim appearance of the ship as a whole, and of *all parts thereof,* and he shall have the necessary authority, as the representative of the commanding officer, to enable him to carry out his duties in this respect." This indicates that the first lieutenant is responsible for the material condition of the entire ship with the exception of certain definitely excepted parts of the engineer department. The various heads of departments and division officers are each responsible to the first lieutenant.

To take up the joint responsibility of the deck division officers to both the gunnery officer and the first lieutenant. It is quite unlikely that any one officer could properly direct all the deck divisions in both gunnery and material upkeep. Even should an officer have sufficient energy and ability to handle both jobs there would be the inevitable tendency to concentrate upon one to the disadvantage of the other. Under the present organization the first lieutenant is as busy as any other head of department. No changes of the organization can reduce the sum total of work that must be turned out by some one. If there is enough work to keep one officer busy, it appears desirable that he be an independent head of department, rather than merely an assistant to the gunnery officer. With proper co-operation the gunnery officer and the first lieutenant should be able to jointly direct the division officers. In any case of controversy it is the duty of the executive officer to co-ordinate the two departments.

It appears that Lieutenant Commander Esler somewhat underestimates the duties and the responsibilities of the first lieutenant. He does not even mention Construction and Repair title "B" equipage which is carried on the books at several hundred thousand dollars. Surely the custody of this is most important, involving as it does such problems as the accounting for life preservers, fire extinguishers, cots, water breakers, gas masks, and fire hoses and nozzles. The proper expenditure of the current Construction and Repair allotment of considerably more than one thousand dollars a week is another most important duty.

Perhaps the best argument in favor of retaining the first lieutenant as an independent head of department is to list all the activities that come under his cognizance. These are: Officers' bedding and staterooms, keys and lockers, messing arrangements, bags and hammocks, ship's boats, Construction and Repair blueprints and hull book, paint shop, rigger shop, carpenter shop, shipfitter shop, Construction and Repair storerooms and tool room, print shop, blacksmith shop, laundry, ship's service activities, lamp locker, sail and awning lockers, boatswain's storeroom, fore hold, post office, incinerator, ventilating system, fire system, Construction and Repair auxiliary machinery, drainage system, freshwater system, telemotors, voice tube system, pnuematic tube system, flushing system, air ejection system, ground tackle, paravane gear, rescue breathing apparatus, hawsers, towing gear and collision mat.

The Origin of War

(See page 1856, November, 1923, PROCEEDINGS)

CAPTAIN J. H. GRANT, U. S. INFANTRY.—The wisdom or propriety of a member of the military profession in presuming to discuss a subject purely naval in nature must be doubted but when the topic is so broad in nature as to pertain with equal interest to both Services, the ideas of a soldier may, perhaps, receive some consideration. The "Origin of War" in the PROCEEDINGS of the U. S. Naval Institute for November is such a topic.

As far as the origin of war in the remote past is concerned, it may be assumed that the interest involved will be largely academic, unless, as the writer of the foregoing article presumes, a common inception be assigned as the cause of all wars, past and present. In the latter event a more lively concern may be expected, for as a physician knowing the cause of a disease may more effectively combat it, so mankind, knowing the universal motive impelling to war, may more efficiently attack that evil at its source.

In the article under discussion the author assigns the urge of expanding population as the cause of wars. This assumption, he bases upon the Malthusian Doctrine which states "that the tendency of population is to increase in a geometrical ratio without limit, while arable land, therefore food supply increases in an arithmetical ratio with a very definite limit." Eventually then, a condition will arise where the food supply is insufficient for the population unless certain checks upon human increase such as wars, famines, misery, and vice restore the proper balance. War, to the author's mind is the great restorer of this nice equilibrium between the means of existence and population.

Now, the argument advanced is fundamentally unsound in two respects. In the first instance, all wars, as this article and history testify, are not caused by the urge of expanding population. In the second case, the proof on which the argument rests, namely, the Malthusian Doctrine, long ago passed into the limbo of the scientific discard. J. S. Mill, the last economist influenced by Malthus, has been dead these many years.

Let us consider these later allegations in the reverse order. Theoretically, while the tendency of population may be to increase in a geometrical ratio, actually it does not. Furthermore the food supply does not increase in a strictly arithmetical ratio. That Malthus himself doubted the universality of his earlier conclusions may be gathered from the reservations appearing in later editions of his essay. In these, he admitted that in new countries subsistence might increase in a geometrical ratio. As a matter of fact, statistics have long since disproved the belief that "periodical additions to the average annual produce" cannot be made. (See E. Connan—*A History of the Theories of Production and Distribution*—London, 1903). The theory of the Reverend Divine remains of historical interest only.

The mere fact that the argument is faulty may not, of course, invalidate the hypothesis that fundamentally wars owe their origin to the growing pains of an expanding population. Further investigation therefore seems necessary, if the original contention is to be refuted. The quantitative aspect of the problem which here presents itself, is, in the modern view, that populations tend to arrive at an optimum number at which the maximum per capita return will be possible. For every acre of land after a certain point, the return per head will diminish *but only* if the art of agriculture (as well as all industrial development) remain stationary.

An increase in skill will lead to an increased return, hence to a larger population per acre. Population sometimes falls short of this number, sometimes equals it, and occasionally exceeds it. In the latter event, there shortly results a diminishing return per head. Poverty ensues, vice increases, and disease becomes more prevalent. These factors in conjunction with sporadic wars aid in restoring the population to the optimum number.

But here, it should be noted, that the sum of such agencies is not in itself sufficient to restore the desired balance. Hand in hand with these natural checks which are always at work, the population itself develops a tendency to restrict its own growth. For the higher types of civilization this inclination first manifests itself in a decrease in the size of the families (i. e. birth rate) of the upper classes. As the economic struggle grows more intense the tendency transmits itself to the lower classes. Among other things, for these categories, marriages are made at a much later age, a factor which also limits the progeny. Meanwhile should any increase in industrial skill take place (and such increases are frequent) the return per head will again increase, hence the optimum number.

Not only does population tend to restrict itself among the higher nations but also among more primitive peoples this inclination manifests itself. Here, by means of abortion, infanticide, prolonged lactation, and periods of cessation of intercourse, as well as in some instances, by perpetual wars, the population is kept at the desirable density.

The purpose of the foregoing remarks should now be evident. Wars do not owe their common and perpetual source to the urge of expanding population because mankind has an inherent tendency to regulate his numbers at the most desirable limits.

The truth of this statement is vouched for by a careful scrutiny of all history where it will be found that throughout long periods of time the world's population has remained stationary until human skill justified an increase. The rapid enlargement of Europe's population at the beginning of the nineteenth century is attributable to the so-called industrial revolution. Meanwhile regardless of a stationary or growing number of inhabitants wars have continued to be numerous. In view of the fact set forth, the belief that war's common origin is to be found in the urge of an expanding population becomes untenable.

Although growing pains are thus ruled out as the common source of the great evil, there is no reason for believing that constantly augmented numbers have not, along with many other factors, played their part in causing some (but not all) wars. Some typical examples of the relation of population to war may be of value in this discussion. One thousand years ago, roughly speaking, the people of the Scandinavian peninsula were busily engaged in carrying war to various parts of Europe. But, *mirabile dictu,* the population of these countries is greater today than it was at that time. Furthermore in modern times these nations have been extremely peaceful. The change in attitude is to be accounted for by the gradual variation in the mental outlook, which in turn in recent years has been influenced by the size of the population. The Dane of today would undoubtedly assure you that his country is a small nation which desires to be let alone. How different from the views of the Norseman a millenium ago!

A yet more interesting example of the influence of population upon the war problem is provided by a consideration of the Franco-German attitude prior to the year 1914.

Shortly before, or shortly after 1870 (the exact date is immaterial), European students and economists again became interested in the population question. Early in the course of investigation, it became apparent that the German people were increasing rapidly while France's numbers remained stationary. Of this fact French publicists and alarmists were not slow to take advantage, hence Germany was pictured as a teeming country anxious to expand into the fertile fields of France. Naturally the French view in turn developed a marked sentiment among German writers who began to look upon the French as a decadent people whose exploitation and development by Germany was not only natural but also desirable. These viewpoints furthered a mutual distrust. The population problem had in this instance a definite psychological effect and undoubtedly helped prepare the ground for the war that followed. As a direct cause, however, it was only one of several acting and not the most powerful at that. If, indeed, the urge of a growing population *per se* ever hurled a people into war, China should surely have been flinging herself against the world these many years—yet the Chinese have been notoriously peace loving as far as external conquest is concerned.

If an origin of war is to be sought, the field for research is human nature. Antiquely, it may be imagined that wars or the beginnings of organized fighting owed their inception to man's pugnacious instinct, although, be it noted, that modern war can not be ascribed to the instinct of pugnacity. War as history records it, whatever its ultimate origin, is a part of traditional human nature, and about nine tenths of human nature is tradition. War is the traditional method of settling disputes. Disputes are psychological manifestations involving differences of opinion over matters physical, mental, or spiritual. If the clash of opinion be strong enough, if national wills remain obdurate, war, the personification of the ultimate force is introduced to settle the vexing issue.

Fundamentally the problem involved in the abolition of war is that of changing, not germinal but traditional human nature. Limit population as you will, but men will continue to fight as long as fighting is regarded as the proper means to the end. The tradition of warfare as the most suitable means of settling difficulties is not universal. The Eskimos in fact have a large body of tradition which makes war a positive evil and wars seldom take place among them. Our problem then seems to be, to become like the Eskimo, in this respect at least. Traditional ideas can be changed but the process is slow.

Does the Navy Need a Naval Reserve Force?

(See page 1419, September, 1923, PROCEEDINGS)

LIEUTENANT COMMANDER F. E. CROSS, U. S. N. R. F.—From the standpoint of Naval preparedness, the answer to the topic of this discussion is, of course, unanimously affirmative. It is a problem that vitally concerns not only the Navy, but the National Defense as well. So acknowledging the need of a Naval Reserve Force, it would seem logical to inquire from what source the most satisfactory supply of personnel can be obtained. As this important feature of the subject was not taken up by Lieutenant Commander Bogusch in his interesting article, it would seem irrelevant to allow the question to pass unheeded. Certainly a Reserve Force that may fail to merit the respect and confidence of the Regular Navy, stands in a fair way of becoming a repetition of the erstwhile Naval Militias of several of our seaboard and lake states which, as is well known, were comprised almost entirely of landsmen and amateur sailors.

The conception of maritime greatness, or sea power, arises from a satisfactory co-ordination of its two determining factors: viz., naval and merchant shipping together with their several establishments, ashore and afloat, and their personnel. Granting which, in the deduction to be followed when considering the enrollment of officers and men in the Reserve Force, close attention should necessarily be invited toward the channel of natural supply, the personnel of the merchant marine.

Here are a large body of experienced seamen; men imbued with that fundamental quality so indispensable to the true sailor, the sea habit; and moreover, men who would welcome an opportunity to receive the annual training given to Naval Reservists. The customary lure of a summer cruise in order to gain recruits would be of no particular interest to merchant seamen, because they are always cruising. That which would draw them would be brief change from their laborious grind in merchant ships, to the instruction they would annually receive in signaling, small arms practice, the manual at arms, gun fire, etc. Summer or winter, afloat or at a naval station ashore, they would gladly report as directed, to perform the required drills.

Comparatively few merchant marine officers have remained in the Reserve Force due to the fact that their status, as they see it, at least,

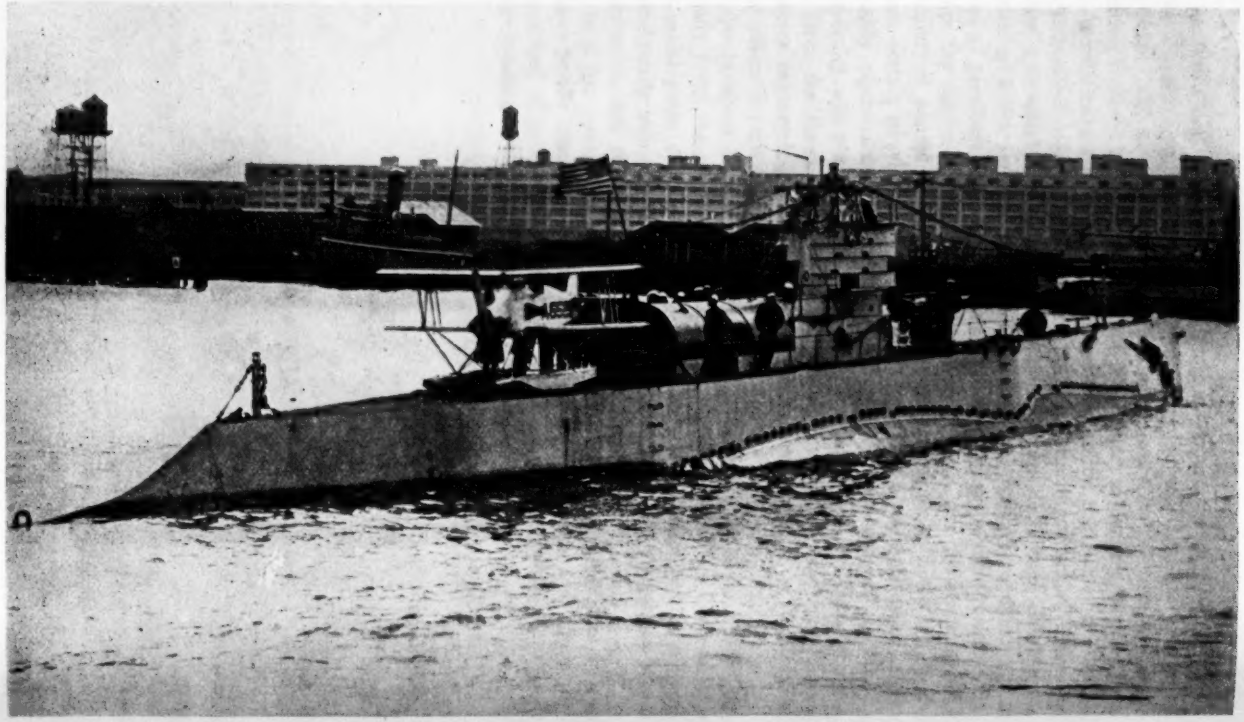
is tentative and obscure. No training whatsoever is demanded; no examinations are required; no system of promotion exists, so far as is known to them. All agree that the retainer pay is very liberal; but the idea of getting something for nothing is not, altogether, a pleasing thought.

Among merchant officers is current the feeling that Class 2, for some misconceived reason, is in better standing with the Regular Navy than Class 3 to which they belong. As qualified, capable officers, constantly in touch with the sea and ships in a professional way, there exists a good deal of perplexity on that score, and anyway—why the class system? Or, since the class system does exist, why not offer Class 3 officers a certain amount of annual training and encourage promotion to Class 2? In any case, certain naval training is very essential for a multiplicity of reasons readily conceivable and until it is offered and encouraged, the Class 3 Reservist will not feel that he is an integral part of the Reserve Force.

Since the Navy put store on seamanship, navigation, ship handling and marine engineering, will not ideal Naval Reserve material be found among the officer personnel of the merchant marine?

An excellent supply of younger officer material could be enrolled annually from the graduates of the State Nautical Schools. Commissioned as midshipmen and by attending such annual drills as might be required, these young men should receive advancement in rank in proportion to such success as they might attain in the merchant marine.

In a few years' time, by adopting a policy along approximate lines as above briefly stated, a truly efficient reserve should be well under way, comprised of professional ships' officers who would be proud of their rank and standing in the Naval Reserve Force.



"M-2" Submarine Boat and Submarine "S-1" at Naval Air Station, Hampton Roads

PROFESSIONAL NOTES

PREPARED BY

LIEUTENANT COMMANDER H. B. HIRD, U. S. NAVY

AND

LIEUTENANT J. B. HEFFERNAN, U. S. NAVY

GENERAL ARRANGEMENT

VESSELS BUILDING
NAVAL POLICY
MATÉRIEL
PERSONNEL
- Great Britain 265
- France 275
- Germany 280
- Japan 285
- United States 288

MERCHANT MARINE 294
ENGINEERING 297
AERONAUTICS 304
ORDNANCE 310
NAVIGATION AND RADIO 313
MISCELLANEOUS 318
CURRENT NAVAL AND PROFESSIONAL PAPERS 324

GREAT BRITAIN

THE IMPERIAL CONFERENCE AND DEFENSE.—*Army, Navy and Air Force Gazette*, 17 November, 1923.—An official summary of the proceedings of the Imperial Conference, which lasted from October 1 to November 8, was issued on Monday. The Conference gave special consideration to the question of defense and the manner in which co-operation and mutual assistance could best be effected after taking into account the political and geographical conditions of the various parts of the Empire. There was a full and frank interchange of views in which the standpoints of the various representatives and the circumstances of their countries were made clear. There were also discussions at the Admiralty and Air Ministry at which naval and air defense was dealt with in greater detail.

In connection with naval defense one matter of immediate interest came before the Conference, namely, the projected Empire cruise of a squadron of modern warships. The Dominion Prime Ministers expressed their appreciation of this proposal, and assured the Conference that the ships would be most heartily welcomed in their countries.

After the whole field of defense had been surveyed the Conference decided that it would be advisable to record in the following resolutions its conclusions on the chief matters which had been discussed:

(1) The Conference affirms that it is necessary to provide for the adequate defense of the territories and trade of the several countries comprising the British Empire.

(2) In this connection the Conference expressly recognizes that it is for the Parliaments of the several parts of the Empire, upon the recommendations of their respective Governments, to decide the nature and extent of any action which should be taken by them.

(3) Subject to this provision the Conference suggests the following as guiding principles:

(*a*) The primary responsibility of each portion of the Empire represented at the Conference for its own local defense.

(*b*) Adequate provision for safeguarding the maritime communications of the several parts of the Empire and the routes and waterways along and through which their armed forces and trade pass.

(*c*) The provision of naval bases and facilities for repair and fuel so as to ensure the mobility of the fleets.

(*d*) The desirability of the maintenance of a minimum standard of naval strength—namely, equality with the naval strength of any foreign Power in accordance with the provisions of the Washington Treaty on Limitation of Armaments as approved by Great Britain, all the self-governing Dominions and India.

(*e*) The desirability of the development of the Air Forces in the several countries of the Empire upon such lines as will make it possible, by means of the adoption, as far as practicable, of a common system of organization and training and the use of uniform manuals, patterns of arms, equipment, and stores (with the exception of the type of aircraft), for each part of the Empire as it may determine to cooperate with other parts with the least possible delay and the greatest efficiency.

(4) In the application of these principles to the several parts of the Empire concerned the Conference takes note of:

(*a*) The deep interest of the Commonwealth of Australia, the Dominion of New Zealand, and India, in the provision of a naval base at Singapore as essential for ensuring the mobility necessary to provide for the securing of the territories and trade of the Empire in Eastern waters;

(*b*) The necessity for the maintenance of safe passage along the great route to the East through the Mediterranean and the Red Sea;

(*c*) The necessity for the maintenance by Great Britain of a Home Defense Air Force of sufficient strength to give adequate protection against air attack by the strongest air force within striking distance of her shores.

(5) The Conference, while deeply concerned for the paramount importance of providing for the safety and integrity of all parts of the Empire, earnestly desires, so far as is consistent with this consideration, the further limitation of armaments, and trusts that no opportunity may be lost to promote this object.

RELATIVE NAVAL STRENGTH.—*Naval and Military Record*, 14 November, 1923.—Apropos the forthcoming program of construction for the United States Navy, the American Navy League has published a tabular statement showing the present relative strength of the United States, British, and Japanese Fleets. The British Empire is credited with forty-eight cruisers of 252,990 tons built and building, the United States with ten of 75,000 tons, and Japan with twenty-five of 157,730 tons. Applying the 5-5-3 ratio to ships of this type, the United States is seen to require nineteen new cruisers of 187,883 tons to balance its fleet, while Great Britain, on the same basis, would be up to her full ratio if she built one additional cruiser of 9,893 tons. This method of comparison, however, is rather misleading, ignoring, as it does, the age and efficiency of existing ships.

Only a fraction of the forty-eight cruisers owned by the British Empire are fully efficient while, on the other hand, the ten American and the twenty-five Japanese units are all of the most modern construction.

Turning to submarines, the table shows that of "large, sea-going, long-radius" boats Japan has twenty-eight built and building, Great Britain seventeen, and the United States six. Therefore, to maintain the 5-5-3 ratio, this country would have to build twenty-nine and the United States forty more submarines. Destroyers do not appear to be mentioned in the statement, though they represent a vital element of naval strength. Failing an adequate number of these craft, both the Navy and the merchant shipping of a belligerent Power would be exposed to devastating attack by submarines.

According to the last Admiralty return, dated January 1, 1923, there were at that time just over 200 destroyers in British and Dominion service. The United States has at least 300 of these vessels, so that we are about 100 short of the establishment required to give us equality. As regards submarines, the American Navy League's statistics appear to stand in need of correction. Taking 800 tons as the minimum displacement of "sea-going, long-radius" boats, the British Empire has only forty-one boats as large as or larger than this, built and building, while the United States has fifty-six. It is, however, almost impossible to devise a formula of relative strength which would be accepted without qualification by the naval experts of any two countries. Statements have recently appeared in American papers, on the authority of distinguished naval officers, to the effect that the United States battle fleet, though almost equal numerically to the British, is actually only half as strong in fighting value on account of the low elevation of its guns, the absence of bulge protection, and the inclusion of several coal-burning ships. No doubt this claim is made in all sincerity, but we doubt whether any British naval authority would concur in it.

Then again, the discrepancy in the American Navy League's tabular statement of submarine strength reveals the difficulty of finding a common standard of value. In fixing the British total of "long-radius" submarines at seventeen the League has obviously included our *K* boats, which, in fact, have a restricted radius of action. Further, this total includes our latest class of *L* boats, of 960 tons, while the ten American *S* boats, of 906-993 tons, are for some reason omitted from the American total. Actually, as we have seen, the United States Navy now contains a greater number of large submarines than the British Navy.

THE FIRST SEA LORD'S WARNING.—*Army, Navy and Air Force Gazette*, 17 November, 1923.—It is rarely that the toast of "The Navy" at the Lord Mayor's banquet is replied to by the First Sea Lord. Only, it may be said, when there is a definite pronouncement to be made of unusual importance before such a distinguished and representative assembly does this happen. Special attention should, therefore, be given to Lord Beatty's remarks yesterday week. They were chiefly devoted to the subjects of the air, Singapore, and *personnel*. What he said about the first-named is well calculated to confound those who have been carried away by their enthusiasm for aeroplanes into supposing that the battleship is "useless," and also those who would keep the Navy deprived of its own air arm. It is imperative, said Lord Beatty, that this arm of the Navy should be developed, unhampered, side by side with the gunnery, torpedo and other arms which go to make up fleet efficiency, and that a proper proportion of the *personnel* of the Navy should be devoted to its development, as is the case with the other arms. Very significant was the First Sea Lord's remark that the decision in regard to the capital ship being able to withstand modern forms of attack, both below and above

the water, was confirmed by *all* officers who have held important command within the last ten years, the period during which the new menaces have developed; that naval architects corroborated it; and that their views were in turn confirmed in America and Japan.

Surely this affords overwhelming testimony to the soundness of the policy of the Admiralty on its material side. But ships alone do not make an efficient fleet, and even more significant in its way was Lord Beatty's warning in regard to the *personnel.* He admitted that by a 5-5-3 ratio we are now below our numbers. Our larger requirements in cruisers render this shortage more pronounced. Not only must a halt be called in post-war reductions, but "some expansion will be necessary." The First Sea Lord, however, is not content merely to count heads. None realizes more than he how very much depends upon the loyal, enthusiastic and willing service of each officer and man. Now of the efficiency of the *personnel,* its discipline and spirit, at the present moment, he could speak with pride, said Lord Beatty, but "their well-being and contentment must be maintained, and the conditions of service must be such as to attract the best we had got." This is the answer, as we have so often advocated in this journal, to those who, by tinkering with the pay of the fleet, would hamper the Admiralty in their task of maintaining our vital naval efficiency.

HELIUM GAS IS AVAILABLE FOR BRITAIN.—*New York Tribune.*—Toronto. —Although the Honorable George P. Graham, Canadian Minister of Railways, informed the Imperial Conference recently that Canada is not much interested in lighter-than-air craft, recent developments in both Britain and the United States in the projection of dirible airship services are being followed with considerable attention.

What Mr. Graham doubtless meant was that for present practical purposes Canada finds the airplane more suited to her purposes and, while attempts at establishing passenger and mail air routes have not been as successful as they have been in Europe, there is probably no country in the world where more practical use is made of the airplane than in Canada.

It is used for fire ranging, exploring, survey work, timber cruising and a variety of special missions. Thus, the other day, for the first time in history, a Lieutenant-Governor and a Premier of Ontario visited Hudson Bay. With their party they went in by canoe. The trip out by the same conveyance might have taken twelve days.

Two airplanes met them and brought them out to civilization in two hours. Commercial flying is taking its place as one of the regular industries of the country, but so far without experiments with dirigibles.

The ambitious British dirigible scheme, now officially indorsed by the British Government, has, however, a great interest for Canada in two ways.

In the first place, it will bring Canada as close to the heart of the Empire as Chicago is to New York. While the scheme is primarily designed to connect England with Egypt, India and Australia by regular services, a secondary route projected is from Britain to Canada and the time schedule for the route is only thirty hours.

In the second place, Canada has the essential raw material for the new dirigibles in her large deposits of the light, inert gas known as helium. So far as known, Canada has the only important deposits of helium to be found in the British Empire, her supply being only exceeded anywhere by that of the United States.

Helium is now known to be present in practically all "natural gas" which is used in many parts of Canada and the United States for illuminating and heating purposes. Richness in helium varies, but the natural gas

of Southern Alberta, which is used in Calgary and the surrounding country, contains about one-third of one per cent of helium.

The total natural gas production of Canada is around 15,000,000,000 cubic feet annually. If it averages one-third of one per cent in helium there would be a total helium content of 50,000,000 cubic feet. This would be sufficient to inflate ten of the 5,000,000 cubic feet capacity ships which, under the British Empire scheme, it is proposed to build.

Designers, however, do not propose to use helium exclusively for the inflation of the British ships. The supply might not be sufficient—at least from all British sources, and the United States, according to announcement of Dr. R. B. Moore, of New York, at a recent mining convention at Montreal, will probably soon prohibit the export of her helium.

In the British design helium will be used as an envelope for the main gas bag, thus giving the necessary protection against combustion and requiring only a fractional volume of the rare gas.

NEW BRITISH SUBMARINE FASTEST, BIGGEST IN WORLD.—*Boston Transcript*, 26 November, 1923.—London, November 26.—The submarine *X-1*, which is nearing completion at a Chatham dockyard for the British Navy, will be the longest as well as the fastest submersible craft in the world, according to the *Morning Post*. She will have a surface speed of thirty-three knots, thus enabling her to accompany battleships when steaming at full speed. The submarine will carry six 5.5-inch guns, an armament said to be unique for an under-sea craft. Her displacement will be 3,500 tons. It is recalled that the first British submarine, built in 1901, displaced 120 tons and had a surface speed of nine knots.

THE NEW NAVAL PROGRAM.—*The Engineer*, 16 November, 1923.—Discussing the cruiser situation in a leading article in our issue of October 19 we referred to the reports then current of an impending program to make good the Navy's shortage of such vessels, and expressed the hope that new ships would, in fact, be laid down at a date not too remote. By a happy coincidence, less than a week after the appearance of this article the Prime Minister announced that the Government had decided to replace the obsolete cruisers of the "County" class, and that it was hoped to allot the contracts for their successors at the turn of the year. Although the immediate purpose of this decision is to mitigate unemployment in the shipyards, the naval situation itself fully justifies the Government's action, which is, therefore, to be welcomed on grounds other than those of mere economic expediency. Owing to the suspension of all cruiser construction in this country since 1918, we have fallen behind other Powers in this important class of naval tonnage, and a vigorous effort will be needed if we are to make up the leeway. As we pointed out recently, no less than thirty-six cruisers, with a displacement of 250,000 tons, have been built or ordered for various foreign navies in the last five years, during which period not one ship of equivalent type has been laid down for the British Navy. Full particulars of the new program are still awaited, but there is reason to believe that it embraces a large number of vessels. Two ships, it is stated, will be built at Portsmouth and Devonport respectively, and other Royal yards are endeavoring to secure a share of the work. From the Prime Minister's pointed allusion to the dearth of employment at Barrow and on the Clyde, it seems probable that special consideration will be shown to those districts when the contracts come to be awarded. The cost of each vessel can scarcely be less than £1,500,000, and may be more, for the *Raleigh* class, of 9,750 tons, have averaged £1,600,000, and the new ships are expected to have the maximum displacement permitted by the Wash-

ington Treaty: viz., 10,000 tons. They will thus approximate in size to the ships they are replacing, for the first ten "County" cruisers, built more than twenty years ago, were of 9,800 tons, and the six later vessels of 10,850 tons. All of these sixteen ships have now disappeared from the Navy List, the last survivor, the *Devonshire*, having been handed over to the shipbreaker only a fortnight ago. They were built as an ocean-going type for the protection of commerce, a function which is also expected to govern the design of their successors.

That the limited number of cruisers possessing high speed and an extensive radius of action imposed a severe handicap on our naval strategy at the outbreak of war in 1914 is admitted by the official historians. It is true that twenty cruisers in all were built under three successive programs—from 1912 onward—but none of them were actually ready when hostilities began, and in any case vessels of this particular class, having been designed expressly for attendance on the battle fleet, were quite unsuited to the requirements of ocean patrol duty. As Mr. Churchill explained in 1912, when introducing the class, of which the *Arethusa* was nameship, they were to be "the eyes and ears of the battle fleet by night and day; to watch over it in movement and at rest, and generally to be available for the purposes of observation and reconnaissance." In this capacity they proved signally successful. It speaks volumes for the excellence of their design and construction that nineteen out of the original twenty should have survived the war, in which all of them performed most arduous service, not a few being badly damaged by mine and gunfire. In 1916-17 were laid down the five *Raleighs*, of greatly increased dimensions and armament. They were planned with a view to the protection of the ocean routes from enemy surface raiders; but with the gradual disappearance of that menace their construction was slowed down, and the war ended before the first ship of the class was ready for the pennant. The class is still incomplete by two units—the *Effingham* and *Frobisher*—whilst the *Raleigh* herself was wrecked in August, 1922, and the *Cavendish* was converted into an aircraft carrier under the name of *Vindictive*. Fine ships as these are, the cruisers now projected will probably surpass them in all respects. A speed of 30 to 31 knots is no longer adequate in view of the high velocities attained by recently completed foreign cruisers, several of which—*i.e.*, the American *Omahas*—have made 34 knots on trial. The Washington Treaty allows "auxiliary combatant ships" to mount guns up to the 8-in. caliber, but whether or not full advantage will be taken of this permission in the case of our new ships remains to be seen. At least two foreign Governments have adopted the 8-in. gun for their latest cruisers. Much as the advocates of the 6-in. gun—the heaviest piece capable of being worked by hand—may deplore the change, it is certain that the future lies with an armament controlled by machinery, such as is mounted already in the ships of the *Raleigh* class, which carry seven 7.5-inch guns apiece. Once more the cycle of cruiser armament approaches full circle, and, just as the 4-in. quick-firing gun was superseded by the well-tried and popular 6-in., so the latter must now give way to a larger caliber. It is many years since an 8-in. gun appeared in the ordnance tables of the British Navy. The 7.5-in. model first came into our service when the battleships *Triumph* and *Swiftsure* were purchased from Chile in 1903. Apparently it gave satisfaction, for the same caliber was straightway adopted for the later "County" ships, and subsequently for other armored cruisers. It is reassuring to know that reliance on machinery for the working of the guns in our modern cruisers involves none of the risks which hampered progress so much in the past century. Machinery, whether applied to guns or to any

other part of a fighting ship's equipment, came through the late war with flying colors, and its continuous development, as applied to armament, has rendered it of great value. For instance, we understand that the latest form of control allows the heavy 7.5-in. pieces to be worked with far more precision of movement than could be attained with 6-in. guns maneuvered by hand. For this reason, among others, the offensive power of the *Raleigh* class is higher than is generally appreciated. So far as broadside discharge is concerned, few rivals other than capital ships would care to try conclusions with them.

While the side armor and horizontal protection of our war-time cruisers, light though it was, appears to have been adequate, there is scope for improvement in other directions. Vessels of the *Raleigh* class were the first British cruising ships to be fitted with anti-torpedo bulges, a feature which is certain to be perpetuated in all our future men-of-war above a certain displacement. In most of the foreign cruiser designs of recent date, the primary guns are placed in closed turrets. No one who has studied the details of the various cruiser actions during the war will be inclined to challenge the wisdom of this policy. The introduction of high-explosive shell has made the open gun shield a veritable death-trap. In the daylight action at Jutland, H.M.S. *Chester* had most of her gunnery *personnel* laid low by splinters, while a few rapid salvoes of small shell from enemy ships that ran past the second Light Cruiser Squadron after nightfall silenced practically all the guns in the *Southampton* and *Dublin*. Open shields afford indifferent protection to direct hits, and none at all to shell bursts inboard. For this reason we would strongly advocate the adoption of closed turrets for all future cruisers. The armor need not be of great thickness; considerations of weight alone would preclude turrets that were proof against the impact of heavy projectiles. But the deadly splinters that follow each burst of high-explosive shell can be kept out by two inches or three inches of steel. This question of gun protection is a technical detail of capital importance, which is not likely to be overlooked in the design of our new cruisers.

British Navy Aircraft Carriers.—*Engineering*, 2 November, 1923.—A great development has taken place in the use of aircraft for fleet purposes since the establishment of the Royal Naval Air Service, a few years before the war. All nations have recognized this, and their navies now include vessels specially arranged for the carriage and operation of aircraft. It was early perceived that a new factor had come into existence whose effect upon the tactical handling of fleets was likely to be of a revolutionary character. By skilful use of a smoke screen it had been possible hitherto for an enemy to break off an action and escape, but the participation of aircraft in a naval action rendered this maneuver no longer of service. The use of aircraft enables all the movements of an enemy to be immediately observed and allowed for, and therefore simplifies many of the problems of gunnery control; while aerial reconnaissance will give the admiral in command exact knowledge of the composition and disposition of the enemy's forces long before actual contact between the fleets has been established.

The limitations of the usefulness of aircraft when flown from a shore station are obvious, and so are the difficulties of handling seaplanes from ordinary ships by means of derricks, and of flying these machines from the water in an average seaway. From this has resulted the inception of the aircraft carrier, a vessel specially designed to carry airplanes, and in its further development, to enable them to be flown off and landed on the deck.

The importance of aircraft carriers has been steadily increasing, and they have been honored by special mention in the Washington Naval

H. M. Aircraft Carrier "Furious." *Engineering*, 2 November, 1923

Treaty in which they and capital ships are the only types of warships which are defined and limited. In Part IV of that Treaty an aircraft carrier is defined as a ship having a displacement (ex-fuel) of above 10,000 tons, designed for the specific and exclusive purpose of carrying aircraft. The maximum displacement of any aircraft-carrying ship is limited at 27,000 tons, except that for provision of conversion of vessels built as capital ships 33,000 tons each is allowed in the case of two ships. The armament of aircraft carriers, as for light cruisers, is limited to guns of a caliber not exceeding eight inches. The combined tonnage of all aircraft carriers possessed by the British Empire must not exceed 135,000. It is also provided that all aircraft carriers building, or in existence on November 12, 1921, can be replaced without regard to age within the total tonnage limit prescribed. This would enable any, or all, of the existing carriers in the British Navy to be scrapped, if desired. Although it is most improbable that full advantage will be taken of this proviso, the generous allowance of total tonnage opens up a fair prospect of naval shipbuilding in this direction.

The earliest aircraft carriers in the British Navy consisted mainly of cross-Channel steamers which were fitted to carry seaplanes; no facilities were provided for the flying off or landing of aeroplanes. Among these ships were the *Empress, Engadine, Riviera, Ark Royal, Ben-My-Chree, Vindex* and *Manxman*. Experiments carried out on these vessels, as well as on the *Campania* and *Furious*, revealed the possibilities of flying off and landing, and enabled the usefulness of aircraft carriers to be very sensibly augmented. The carriers now on service or completing are the *Ark Royal* and *Pegasus*—small ships of the older type, and the *Argus, Eagle, Hermes* and *Furious* which are well-equipped up-to-date ships. All these vessels except the *Hermes* have been converted for their present service. The *Hermes* was specifically designed for the purpose.

Of these vessels the *Argus* was described in *Engineering* on March 28 and April 4, 1919. She was launched in July, 1917, and is the only modern type carrier yet actually on service. H.M.S. *Furious*, originally a cruiser, was completed in July, 1917, and is now undergoing a further reconstruction. The *Eagle* and *Hermes* have each just completed their trials. Particulars of these ships, together with the older carriers are given in the table below:

Ship	Length	Navy List Displacement	Designed Horse-Power	Approximate Speed
Ark Royal	366	7,080	3,000	11
Pegasus	332	3,070	9,500	20¼
Argus	565	14,450	20,000	20.2
Hermes	598	10,950	40,000	26
Eagle	667	22,790	55,000	25
Furious (before present reconstruction)	786	19,100	90,000	31

For comparison, it may be stated that the only other completed aircraft carriers in existence are the U.S.S. *Langley* (described and illustrated in our issue of September 14 last), which has a length of 524 ft., a displacement of 19,360 tons and a speed of 14 knots, and the *Hosho*, of the

Imperial Japanese Navy, which was completed in 1922, and has a displacement of 9,500 tons.

The *Hermes* was designed by the Director of Naval Construction and built at the Naval Yard at Walker-on-Tyne of Messrs. Armstrong, having been laid down in January, 1918, and launched in September, 1919. To the particulars given in the table p. 273 may be added: Breadth, 70 ft. below, 90 ft. at flight deck; draught, 18 ft. 9 in.; oil fuel stowage, 2,000 tons. She was considerably delayed in her early stages by important alterations and improvements in design which were made as the result of further experience in mid-1918; and some delay of necessity arose when she was transferred to Devonport Dockyard to complete. As already stated, she is the only aircraft carrier designed and built as such, and has thus escaped the disadvantages inseparable from a reconstructed ship; but the length of time occupied by building and completing her, although unavoidable, is rather apt to be prejudicial to a ship's final efficiency, and it is therefore a matter of congratulation to all concerned that she has undergone a most extensive series of trials with—as we understand—complete success.

Very few particulars of the *Hermes* have been published; but it is known that she is provided with anti-torpedo blisters and is propelled by twin screw geared Parsons turbines. Her armament consists of six 5.5-in. and some anti-aircraft guns. Like the *Eagle* she is provided with an "island" unsymmetrically placed on the starboard side of the flight deck, which contains the funnels, mast, fire control and navigating positions. Apart from these rather scanty particulars, little information is available; but it may be of interest to refer to some features which are common to all modern aircraft carriers.

One of the most important peculiarities of an aircraft carrier is the provision of a smooth flight deck on which aircraft can be safely landed. To ensure this it is desirable to reduce all air eddies immediately above that deck to a minimum. To design the upper works of a ship so as to avoid eddying is a rather novel problem for a naval architect, inasmuch as air resistance is of small importance in comparison with that of the underwater form through the water. This problem of the above-water form, although different from the familiar ones associated with the underwater form, resembles them in one respect—it is not completely amenable to mathematical treatment. Model experiments provide the only means to a solution; and it is understood that such experiments are undertaken and the results utilized for the upper works design.

In this connection it should be noted that the flush deck arrangement without funnels, employed on the *Argus*, and since adopted for the *Langley*, has not been adhered to in the case of either the *Hermes* or the *Eagle*. With such a flush deck horizontal "funnels" are used discharging aft, or near the ship's side below the flight deck. The advantages of such an arrangement for an alighting aircraft are clear inasmuch as the absence of any "island" or superstructure above the flying deck conduces to the suppression of eddies. It appears, however, that a flush deck vessel must be somewhat difficult to navigate; and it is also probable that the large horizontal ducts encroach considerably on valuable space required for other purposes.

A hangar having the maximum accommodation possible is a *sine qua non* in an aircraft carrier. This is necessarily a very long compartment without partitions, which, for reasons connected with watertight subdivisions, must be placed above the water-line. To keep trunks, gearing and leads of various descriptions clear of this hangar is extremely difficult, though absolutely necessary, as it constitutes a danger space from which direct communication to the internals of the ship must be avoided

as much as possible. The hangar cannot be sub-divided; but it is understood that fireproof curtains are hung in it at intervals as to localize the effect of a possible fire outside or within.

As regards the means for handling aircraft, cranes are supplied for embarking or disembarking planes, and lifts for conveying them from the hangar to the flight deck and *vice versa*. The design of these huge lifts constitute one of the most formidable mechanical difficulties associated with the ship, difficulties which become obvious when the size and area of an aeroplane which the lift has to support is remembered. Other features which can be only briefly mentioned here are the provisions of adequate workshop accommodation, the safe stowage of large quantities of petrol, the supply of efficient navigation arrangements and last, but not least, the accommodation required for a large complement of officers and men in a ship where natural ventilation and light are peculiarly difficult to obtain.

A paper of considerable interest in this connection was read this spring at the Institution of Naval Architects by Sir Eustace Tennyson d'Eyncourt and Mr. John H. Narbeth, entitled "A Proposed Aircraft-Carrying Mail Steamer." The type of vessel dealt with therein, although differing from an aircraft carrier design for naval purposes, yet resembles it in many respects; and the paper contains a good description of many of the features common to both types of vessel.

Finally, it will be very evident that the design of a ship from which aircraft can be safely flown presents many difficulties. Even greater ones are encountered by the problem of providing a deck on which such craft can be safely landed. The attention necessarily given to these matters must not be allowed to obscure the old naval problem of securing the best compromise between speed, protection, armament, endurance, and load—which in these ships may be translated into hangar capacity. These difficulties have all had to be surmounted in a very short space of time, and many other features of an entirely novel nature had to be introduced while the aircraft were themselves undergoing a process of rapid development. The success which, it is understood, has attended the trials of these vessels reflects great credit on Sir Eustace Tennyson d'Eyncourt, Director of Naval Construction at the Admiralty, who, together with his staff in the Royal Corps of Naval Constructors, has undertaken the whole of the design work in connection with these ships.

FRANCE

PRESSING FORWARD THE NAVAL PROGRAM: AMERICAN "DETROIT" CRUISER VS. "DUGUAY-TROUIN": BRITISH CRUISER SUPERIORITY: FIRST 2,400-TON "CONTRETORPILLEUR" LAUNCHED: ITS POINTS OF VANTAGE: DIRIGIBLE CRAZE: DIFFICULTIES IN THE WAY: EXTREME VULNERABILITY OF THE WINDBAG TYPE.—J. B. Gautreau, *Naval and Military Record*, 14 November, 1923.—Admiralty instructions recommend the pressing forward of the execution of the forty units of the Guisthau program now in hand. The 8,000-ton *Duguay-Trouin*, now nearly half completed, will run her trials in the late summer, 1924; the *Lamotte-Piquet* is expected to be ready for November, 1924, and the *Primauguet* is due to commence her trials in March, 1925, or even before. In the spring, 1925, France will array the three fastest ocean cruisers in the world with the fastest destroyers. The *Jaguar* will commence her trials next July and the *Chacal* (St. Nazaire) ought to be ready in August. Two drawbacks to quick work are: There is a shortage of labor in most private yards, especially in St. Nazaire; and the grave blunder has been made by the Admiralty of dispersing the orders all over France among some thirty different firms, so that the completion of the program is certain to be delayed, and to be

more costly also, without mentioning unpleasant surprises that might be in store.

The new American cruiser *Detroit* (after the French name of a city of the Great Lakes) is on a visit to Gallic parts, and has excited much curiosity and given rise to interesting comparisons with the 8,000-ton *Duguay-Trouin,* completing at Brest. Those officers who examined her consider the *Detroit* to be a splendid ship and a good investment for her displacement of 7,500 tons. Her armament is relatively powerful, consisting of twelve 6-inch weapons, giving an end-on fire of six guns, all with good arc and command of fire. Here American experts are seen to have with talent applied the lessons of the Great War, in which cruiser contests have invariably turned out to be running fights, with the exception of Coronel. At the Falklands, Dogger Bank, and Sydney-Emden affairs end-on batteries determined the issue. And it will be even more so to-morrow with the growing importance given to speed. Indeed, speed and end-on fire make up the fighting worth of cruisers. The only cruisers before whom the *Detroits* would have to run for dear life are the British *Hawkins,* and the United States greyhounds could easily escape, having three knots to the good. All other British cruisers of the *C* and *D* series are hopelessly outclassed, at least for individual power, but of course two *Cs* would have not much trouble in beating a *Detroit,* if the latter were good enough to wait. At the same time, the enormous British superiority in light cruisers over all comers is a momentous factor for some time to come, all the more so as a *Hood* or a *Renown* would in rough weather be certain to easily catch up a *Detroit* or a *Duguay-Trouin.*

French naval men are satisfied as to the superiority of the *Duguay-Trouin* over her American rival. There are only eight French guns, but they are of slightly superior caliber (155 mil., against 152) and range and are better protected in thicker turrets. Abeam the two cruisers can train the same number of guns: viz., eight, and the French advantage is clear, the Gallic weapons being of more up-to-date design. But it is especially in speed, all-round protection, and torpedo armament that the French *croiseur léger* is seen to advantage. She will develop 110,000 h.p., against 90,000, carry three times as many torpedo-tubes, and have a more extensive light armor. Still, it must be said that the *Duguay-Trouin,* just the same as the British *Delhis,* are judged by many officers to carry too many torpedo-tubes, especially as they offer to an enemy too large and too vulnerable a target to stand a good chance of ever launching their torpedoes, at short range. Rue Royale copied here British methods, against the opinions of many *officiers de vaisseau,* who see in war events no justification of torpedo armament in *croiseurs légers.* Admiral Daveluy went so far as to contest the value of torpedoes in destroyers.

The *Jaguar,* first *contre-torpilleur* of the new program, has just been launched at Lorient, and will run her trials in the summer, 1924, when she will be the finest destroyer in existence, and by a long way. Her design is inspired from the Boche destroyers of 2,300 tons, one of which was incorporated in the French flotillas under the name of *Admiral Senès* (drowned in the Gambetta disaster). The *Senès* was thoroughly examined and experimented upon in all weathers, her good and weak points were investigated, and the result of those careful studies has been the *Jaguar* type, that is free from the notorious defects of the Boche vessels: viz., poor stability, weak bow armament (one 6-inch gun), liveliness, and whimsical rate of going in heavy seas, together with indifferent construction due to war conditions.

The *Jaguar* has a displacement of 2,400 tons, a length of 120 meters, a width of eleven meters, with a draught of 4 m. 50 aft. Her waterlines and the shape of her bows have been the object of special studies and re-

searches in experimental tanks, high speed under service conditions being the aim in view. Structurally she is stronger than the more narrow German *S 116* (now Italian) and *S 113* (French), that were really built for short spurts in the North Sea. In shape and draught the *Jaguar* is more of a cruiser. Her swan-like and overhanging bows, her rather high freeboard (six meters forward), three funnels, and fighting mast contribute to give her an elegant greyhound-like silhouette.

The motor power will exceed 50,000 h.p.—which is nothing amazing, since the *S 116* developed up to 56,000 h.p., and the 2,200-ton Italian *Leone* has produced on trials 44,000 h.p. The trial figures might exceed 60,000 h.p. There are five boilers of the small high-pressure (18 kilos) type, that are being manufactured at St. Nazaire, and two Rateau turbines in hand at Indret (Nantes). The radius of action at 18 knots is estimated at 2,500 miles, and at over 3,000 miles at 14 knots, which will impart great freedom of movement to these boats. But the most remarkable feature is the armament, which is the most powerful yet adopted for vessels of that class. At first it was intended to mount 5.5-inch or 6-inch guns (as in the ex-Boche *Senès*, and in the Italian *Aquilas* of 1,600 tons), but it would have only been possible to find place for three or four of those rather heavy weapons at good height over the waterline, and the bow armament would have consisted of one gun only. Much greater power and about equal range (17,000 meters) will be obtained with six 5.1-inch (130 mil.) guns, all of which will fire abeam, three ahead, and two astern —a sign that the *Jaguar* has been designed for offense. The first bow gun is placed at over seven meters over the waterline, the second and third, immediately behind on a raised platform, are fitted on twin mounting at some 8.50 meters. All this armament is protected by curved shields of good thickness, and is unequalled, all points considered, by that of any rival type. It is calculated to permit a stiff defense to be made against light cruisers carrying nothing heavier than 6-inch calibers. Provisions have been made for the eventual use of a light seaplane.

The 65,000 cubic meter *Dixmude* has accomplished successive flights of 120 and forty-eight hours, and the *Mediterranée* (25,000 cubic meters) recently conveyed Under-Minister Fynac (Aeronautical Department) to Rome and back, and flew the flag of Admiral Dumesnil in the course of recent exercises in the Gulf of Lyons. All these fine performances, that are more noteworthy when compared with the powerlessness of all other Allies to turn to any use the ex-Boche dirigibles delivered to them, have naturally created a demand for a Zeppelin fleet that shall assure safe and quick communications over the Mediterranean with France's African Empire. Windbags capable of singly transporting some forty tons in men, ammunition, or wares, over many hundreds of miles, make a strong appeal to those naval and political men who are conscious of France's present weakness on the water. Unfortunately, there are obstacles in the way which will prevent the latest craze developing. The financial cost of a modern Zeppelin is very great compared with that of the most powerful four-motor *Lydrawion*. A dirigible requires huge and costly hangars, together with a small army of attendants, and without these it is exposed to coming to grief, so much so that the gallant and able officers of the *Dixmude* were not without misgivings in the course of their protracted aerial excursions when they thought that they needed Cuers (near Marseilles) and its hangar to safely alight, and that any accident on the way might be their doom. There are also constructional difficulties to be faced which the Germans alone seem to have completely mastered through long years of painful experiments and researches. The fate of the carefully-manufactured and apparently robust British dirigibles is a warning French experts have not forgotten, and even a French copy of the *Dixmude* would be something of a risky experiment.

Lastly, and it is the most weighty argument against dirigibles, they are extremely vulnerable to weather, ballistic or aerial attacks from the long and wide target they offer to wind and projectiles. New anti-aerial shells have been elaborated that either send tearing splinters over a wide radius or produce poisonous, sticky clouds, calculated to cling (like a Nessus' mantle) to the hull of the dirigible. Even helium-filled balloons are vulnerable to this sort of attack. But the chief danger is the extremely rapid diminutive *avion de combat*, with its various bombs, torpedoes, and its machine-guns, without speaking of the new netting *rateau* designed for the attack of the huge and relatively cumbrous windbags.

Besides, with the constant progress in the design and construction of airplanes, the France-African journey is becoming an easy problem to solve. Three more army officers under Commandant Vuillemin (the famous *as de la guerre*) are testing new heavy machines over the France-Morocco-Dakar route with complete success up to the present. However, fine dirigible fleets are on paper, *escadres d'avions* are finer still: viz., they exist.

NAVAL OUTLOOK: INTENSE TRAINING: INTERNATIONAL CRUISER COMPETITION: WHY THE "DUGUAY-TROUIN" TYPE WILL BE HARD TO BEAT FOR SPEED: UNWISDOM OF SECRECY: THE EXCELLENT BRITISH "FROBISHERS": ALTERNATIVE CRUISER DESIGNS SUBMITTED TO THE "CONSEIL SUPERIEUR": FRENCH MINE-LAYING PROGRESS.—J. B. Gautreau, *Naval and Military Record*, 21 November, 1923.—The Paris Chamber met again, after a three months' vacation, on November 13, in an atmosphere of storm and excitement. On all sides trouble is brewing around France; the only bright point is the firm union of the French nation around the grand President Poincaré and also the military and aerial superiority which could be opposed to mischief-makers. Devastated and half-ruined France is five years after the armistice in a far worse plight than she was in 1914, from the standpoint of security. No wonder that on land, in the air, as well as at sea, Frenchmen are intensely training, experimenting, and arming, bracing themselves up "with a heart for any fate." *La France n'est jamais plus grande que dans le danger.*

The increment of prestige the French Navy received from the command of the three fastest cruisers in the world is being somewhat depreciated by the announcement that Great Britain and all other Great Powers will this year order or lay down superior cruisers of 10,000 tons. A solace for French naval men is the knowledge that the *Duguay-Trouins* will be ready about one year in advance of their British, American, and Italian rivals, and also that they will be after all a good investment, their total cost not exceeding seventy-five million francs, thus about £1,000,000 at the present rates of the money market. The *Duguay-Trouin* will this month reach fifty per cent of its completing stage, and is expected to be ready for her trials in August-September, 1924. The *Lamotte-Piquet*, building in dry dock at Lorient, will be floated next month, when she will have reached thirty-five per cent of her completing stage. The *Primauguet*, though she replaced the *Duguay-Trouin* only two months since on the stocks at Brest, is progressing very rapidly, neither labor nor materials being wanting, and she is expected to be launched next March. The spring of 1925 will see the three 35-knot *croiseurs légers* under trials at sea or in commission. Admiralty efforts to press forward the work in hand are counteracted by the senseless dispersal of orders for hulls, boilers, turbines, and armament all over France. Now is seen the importance, if commands are to be efficiently and quickly executed, of placing the orders solely with first-class up-to-date firms. Unfortunately, since the war a mushroomlike growth of *chantiers navals* has taken place,

every one of those improvised yards claiming its share of Governmental spoils, and bringing electoral pressure to bear upon the hapless Paris Admiralty—a beautiful system more satisfactory to *égalité* than to efficiency.

There is no secrecy about the French 8,000-ton cruisers, save perhaps in what concerns the armor and the anti-submarine and anti-aerial protection. On this point France is right. What becomes of the famous Washington international loyalty clauses if an attempt is made by any signatory to conceal armaments in hand? On the other hand, French naval men, in the light of past experience, see every advantage in letting the public know the efforts being made in favor of the Navy. Practically every journal in the land has published sketches of the *Duguay-Trouins,* with instructive comparisons that contributed to excite public interest in naval affairs and to bring enthusiastic recruits into the service. The veil of secrecy would have proved a barrier to popular interest in the new ships, and it would have proved also a drawback to progress. Discussions between naval men and public criticisms in service journals have brought to light new ideas that will be embodied in future designs, and have created also a demand for better and stronger ships. French naval men have not forgotten the extent to which Gallic submarine efficiency suffered from the secrecy maintained concerning pre-war *sous-marins,* that were jealously kept a State monopoly in the matter of construction, were thought to be far in advance of the world, and, when war came, fell short of expectations. The argument that it is wise to leave prospective enemies in ignorance of your constructional progress is fallacious. The French, for instance, elaborated the Danton design (four 12-inch, twelve 9.4-inch guns) before the plans of the Dreadnaught were known (1905), but when the armament of the epoch-making creation of Admiral Fisher was published it changed nothing in the opinion of the French Admiralty, who had pinned their faith in volume of fire. Just the same thing happened with the Boche cruiser *Bluecher* (twelve 8.2-inch and six 6-inch guns), which its designers thought superior to the *Invincible* type (eight guns of 12-inch), for the reason that they also considered rate and volume of fire (a hurricane of explosives and steel) as the sure factors of victory.

There is a tendency among experts to consider the wholesale construction of rival 10,000-ton cruisers will not depreciate, so much as was feared, the 8,000-ton *Duguay-Trouins,* for the reason that the latter have been designed for speed. Speed is their chief weapon—contrary to Admiral Daveluy's well-known pre-war aphorism: *La vitesse n' est pas une arme.* And their fighting value would receive a blow only if there could be built cruisers possessing superiority both in speed and in armament. Now, that cannot be achieved at a price of a supplementary 2,000 tons. The excellent British *Frobishers,* for instance, carry an armament of seven 7.5-inch guns, much superior to the eight 6.1-inch weapons of the *Duguay-Trouins;* but though they are larger by nearly 2,000 tons, they only develop nominally 70,000 h.p., against over 100,000 for the French ship, and they are outmatched in the matter of speed by some four knots (probably more). Now, in the new British and Italian ships 8-inch weapons heavier than 7.5-inch calibers (in the proportion of one-fourth) and weighing twice as much as the new French 6.1-inch weapons are to be fitted, from eight to ten in number, which means that less displacement will be left available for motor-power and for hull robustness and armor.

As a matter of fact, the value of the *Duguay-Trouin* type—like that of old French *croiseurs-cuirassés*—is protected by the Washington limitation clauses; and the more the post-Washington cruiser problem is examined the more it is seen that the Paris Section Technique struck a good, clever compromise, especially as France, being outmatched numerically, needs to

be superior in speed if real advantage is to be drawn from her cruiser force.

When the *Duguay-Trouin* type was selected by the *Conseil Superieur* a series of alternative plans had been submitted that show the influence of armament on speed, at least if robustness and defensive qualities are to be safeguarded: Firstly, light cruiser of 6,000 tons, ten 5.5-inch guns, 30 knots (improved *Delhi*); secondly, 8,000-ton type; thirdly, 10,000-ton, six 7.6-inch guns, 32 knots (improved *Raleigh*); fourthly, 12,000 tons, six 9.4-inch weapons, 30 knots. It was only after artillery experts had expounded the wonderful qualities of the new 155-mil. long-caliber ordnance, with a new type of shells, estimated to be more than equal in range to former 194-mil. guns, that the *Conseil Superieur* decided on the *Duguay-Trouin*, laying stress on the importance of good protection for the armament both against armor-piercing projectiles and against chemical shells and bombs.

Minelaying is the object of much attention on the part of Rue Royale authorities. Interesting experiments have lately taken place in the Channel and in the Mediterranean with new-type minelayers and mines, the mine being considered as the most economical and efficient instrument both of blockade and harbor defense. For the present France has given up surface *porteurs de mines*, the pre-war *Cerbère* and *Pluton* of 600 tons not having quite come up to expectation on account of their slowness and extreme vulnerability to destroyers of the smallest type. Light mines are to be found in French *cuirassés* and in all large cruisers, but submarine laying is what the Paris Admiralty is preparing with the most care. Up to the present there are only six under-water minelayers in commission, viz., *Astrée, Amaranthe* (Fenaux design, mines on sides); *Victor Réveillé*, of 750 tons and thirty-six mines; *René-Audry* (same type); *Chailley* and *Callot*, both of 940-1,300 tons, 2,900 h.p. Schneider motors, 17 knots, some sixty mines on deck destroyer fashion one gun of 75-mil. bore and six 18-inch torpedo-tubes. (In the *Chailley* there is a slight difference in the number and disposition of mines). Three types of mines are now in use in the French service: *Harlé*, of 360 kilos, containing 60 kilos explosives; *Breguet*, 700 kilos, containing 100 kilos explosives; post-war improved *Breguet*. Mining specialists are steadily increasing in number and in efficiency.

GERMANY

GERMANY'S NAVY HAS GONE, TO GREAT BRITAIN'S RELIEF, BUT FRANCE REMEMBERS THAT THE ARMY WAS NOT SUNK AT SCAPA FLOW.—Hector C. Bywater in *Baltimore Sun*, 7 December, 1923.—London, November 22.—A high official of the French Government, who has been intimately associated with M. Poincaré during the latter's Premiership, recently made the following frank statement to a friend of the writer's:

Security is, for us, the one really vital and imperative need. Reparations come second. We shall, of course, continue our pressure on Germany with a view to making her pay her war debts, but we are far more concerned to prevent any revival of her military power. France will shrink from no measure, however drastic, which may be necessary to insure her future safety *vis-à-vis* Germany.

On this point M. Poincaré speaks not for himself, but for all France, which is absolutely united in its determination to make the country safe for this generation and its immediate posterity. The war brought security to England by eliminating German sea power, as also to Italy by so rectifying her frontiers as to make them virtually impregnable. France and Belgium, on the other hand, were left to face the potential menace of German revenge.

You may destroy a Navy completely by sinking its ships and dismantling its dockyards, as England has destroyed the German Navy; but you cannot

destroy an Army so easily. The framework of Prussia's military system remains intact. The old organization could be made to function again without difficulty. Millions of men, all of them trained, are ready to spring to arms at a word. They lack only equipment, and now that Allied control is no longer exercised the German munition factories are working hard to repair this deficiency.

If France stood with folded arms her arch enemy would be ready to renew the struggle in two, three or four years—perhaps more, perhaps less. Bear constantly in mind this key fact, that France is resolved at all costs never again to undergo the agonies of German invasion, and you will eventually have to admit that our policy, now so bitterly but mistakenly criticized in England, is logical, consistent and sound.

Without a reasonable guarantee of immunity from attack, life would be simply intolerable to us French. On every other problem of post-war settlement we are open to argument or persuasion, prepared as we are to make real sacrifices for the peace and economic health of Europe; but on this one question we are and shall ever remain obdurate. To 40,000,000 Frenchmen the watchword is "safety first," and we shall continue to obey it, come what may.

Whatever we may think of the means that France is employing to gain the end in view, none can question the justice of her claims to be freed once and for all from the dreadful nightmare of invasion. To many, including the writer, it seems as if her methods are more calculated to invite the danger than to repel it.

The German passion for revenge has obviously been inflamed by recent events in the Ruhr and the Rhineland. In every part of Germany men, women and children are starving as the direct result of French policy. It is true that the German magnates, thanks to their crafty maneuvers to avoid reparation payments, are largely responsible for the plight of their country, but to the German masses France, with her iron grip paralyzing the industrial system of the fatherland, is the tangible cause of all their woes and the hatred they bear her is proportionately bitter. The will to revenge already exists.

Three years ago the German people, sick of the very name of war, showed themselves so apathetic to militarist propaganda that Ludendorff in an outburst of spleen, berated them as "soulless sheep." Today great numbers of them see in a revival of Prussian militarism their only hope of emancipation from the foreign yoke.

To that extent, therefore, the French preventive policy has been a signal failure. But the spokesmen of France are not to be convinced. "It is all one to us," they declare, "how the Germans regard us. We know that their hatred of us would have persisted no matter what treatment they received at our hands. In any case we are ready to accept their hostility so long as we are able to deny them the means of giving material effect to it. We would rather have them reviling us in impotent fury than making hypocritical professions of friendship, while they secretly prepared to assassinate us."

It is perfectly true, as the French statesman quoted above points out, that Great Britain gained her chief war objective when the German Navy ceased to exist.

What lay at the root of the antagonism which had been growing up between Britain and Germany from the first years of this century and finally brought them together in deadly combat? Beyond all doubt it was the restless development of German sea power and the consequent threat to that maritime supremacy which Britain justly regarded as her most precious interest.

But for the Kaiser's ambition to pose as "admiral of the Atlantic" it is

improbable that any differences serious enough to provoke war would have arisen between the two people. Trade rivalry was no doubt a factor contributing to the destruction of their age-long friendship, but that it would, of itself, have brought about war—at any rate at so early a date—is not to be believed. The most cursory survey of pre-war diplomacy reveals the over-mastering influence of German naval policy on Anglo-German relations.

As long ago as 1898, when the first great battleship program was adopted in Germany, a few far-sighted people predicted the inevitable result of this challenge. From that time down to 1914 there were thoughtful men in both countries who saw what must sooner or later happen unless Germany could be induced to modify her extravagant naval schemes.

Turning back to survey the past in the light of present wisdom, we can see that war became almost a certainty on the day on which Germany—as she frankly avowed in the famous preamble to the Navy bill of 1900—set about the creation of a fleet so strong that even Britain could not try conclusions with it save at the hazard of her own existence.

This policy was adhered to throughout the next fourteen years. Time after time the original program was amended, always on the upward grade, each new extension, heralded as it was by bellicose words in the German Parliament and press, producing a corresponding reaction of alarm across the North Sea.

So long as this mighty fleet floated at her very threshold Britain could never feel safe. Its shadow lay athwart her future, growing blacker and more menacing year by year. Englishmen in those days felt much as Frenchmen did when they gazed across the Rhine and saw Germany's armed legions massed within easy reach of their frontier.

For how long the two nations could have continued this silent but intensive struggle for the command of the sea is too speculative a question to admit of any definite answer.

By 1914 the financial strain had already become severe for Britain, who, for safety's sake, had to maintain a generous margin of superiority in all types of ships. Thus, she deemed it essential to build at least five ships to Germany's three, and shortly before the war there was talk of adopting the "two keels to one" building policy as the only standard consistent with real security.

It is safe to say that, if war had not intervened, British naval expenditure by 1920 would have reached £85,000,000 to £90,000,000. And yet, in spite of this tremendous sacrifice of wealth the relative strength of the two fleets would have remained unaltered except that Germany by completing the seventy-two submarines for which she had legislated in 1912, would have been able to launch a violent *U*-boat offensive at the very onset of a war.

But Germany's far-reaching schemes of world dominion through the agency of an invincible fleet were fated not to materialize. When war actually came, the British Navy was found none too strong for the work it had to do. For all our supremacy in battleships the *U*-boat campaign came within an ace of causing our defeat.

But when at last the German fleet was brought captive into Scapa Flow there can have been no thoughtful Briton who did not feel as though a great weight had been lifted from his mind. The menace which for years had hung above this land like a black cloud had at length disappeared. Whatever else she had lost or gained by the war, Britain had at least achieved security in the one element where she needed it most.

But for France there was no such consolation. It may be that Frenchmen exaggerate the recuperative power of the German military system. It may be that the secret, well-equipped armies in Prussia and Bavaria, of

whose existence they profess to have knowledge, are phantom armies, conjured up by an overwrought imagination.

Be that as it may the danger is real enough to them, and, on their own admission, they will stick at nothing to avert it. If the total ruin of Germany is regarded as a *sine qua non* of security, they will seek to compass it. If the permanent occupation not only of the Rhine bridgeheads but of the Ruhr basin and contiguous territories as well is held to be no less requisite to the same purpose, France will retain her grip on all those territorities despite protest or censure from any quarter so ever.

To blink these hard facts is to court brutal disillusionment. That France, in her blind desire for safety, has set her feet on a path which must infallibly lead her into deadly peril is a conviction shared by most of her friends, but it is utterly vain to suppose that she is to be turned aside by verbal remonstrance or, in fact, by anything short of *force majeure*. And who is likely to apply that drastic remedy?

Secret Preparations Reported in Germany.—Hector C. Bywater in *Baltimore Sun*, 14 December, 1923.—London, November 29.—The Allied note addressed to Berlin last week, drawing attention to the reported violation of the disarmament clauses of the Versailles Treaty, has had a very bad press in France. M. Poincaré is bitterly upbraided by some of his stanchest supporters for "truckling" to England, and especially for agreeing to postpone the new sanctions which Marshal Foch desired to put into force at once.

The fact that several newspapers known to take their cue direct from the *Quai d'Orsay* have been foremost in condemning the note as too moderate suggests that this criticism, although directed against himself, is not unwelcome to M. Poincaré. It is even conceivable that he inspired it, for there are cases on record of other French Government officials having written leading articles in which their own policies were violently assailed, the object, of course, being to provide a line of retreat, "under pressure of public opinion" from an awkward situation.

But whether in this case the French newspapers are writing to order or not, there is no question as to the temper of French opinion regarding the persistent reports of Germany's secret rearmament. If these reports continue to arrive, or unless the evidence already published can be proved false, not Marshal Foch alone, but the whole French nation will undoubtedly insist on the taking of repressive measures.

One of the last acts of Chancellor Stresemann before his Cabinet fell was to reject, in language of thinly veiled defiance, the Allies' proposals for the resumption of their military control work in Germany. The purport of Herr Stresemann's answer was that, if Allied officers attempted to continue their investigation into the military establishments and arsenals of the Reich, they would do so at peril of their lives.

Scarcely had this reply been published than, by a sinister coincidence, two Allied military officers, French and Belgian, were maltreated at Leipzig one of them being thrust into gaol at dead of night. This incident has been settled by an apology from Berlin, but its significance is unmistakable. Obviously it is no longer safe for the Inter-allied Control Missions to go on with their work under the former conditions.

Henceforth, if German barracks and magazines are to be searched, it will have to be done under the protection of a strong military escort.

If, on the other hand, this surveillance is to come to an end, how far can the Germans be trusted to abide by the provisions of the treaty? Not an inch, asserts Marshal Foch and every Frenchman agrees with him.

"It would be stark lunacy," writes one military expert, "to leave the Germans to their own devices. With their genius for organizing vast

enterprises under the rose, they would have no difficulty in recreating their army of 1918 and equipping it with all necessary weapons. Marked progress has been made in this direction even during the current year, owing to the virtual suspension of control. Give them another two years without supervision, and they will be ready for the long-meditated war of revenge."

Nor are these alarming views confined to French experts. British officers with experience of control work in Germany are just as sure of her capacity and of her will to become a great military power once more.

One of the ablest of these officers, Professor J. H. Morgan, late deputy adjutant-general in Military Commission of Control, declared last week in a lecture that "Germany is still a giant, if a maimed giant—how strong we never realized until we began to disarm her." What has been done in that respect will not, he thinks, render her militarily impotent for always.

The commission has, up to now, destroyed about 35,000 guns and millions of rifles; it has blown up fortresses, dynamited powder factories and dismantled shops at Essen. But it is already a full year since anything like real control has been exercised. Only in the occupied districts of Germany do the Allies know what has been going on during the last twelve months.

French reports—not mere newspaper gossip but official memoranda signed by competent officers—tell of gun, rifle, airplane and poison-gas factories working at full blast in the remoter parts of the Fatherland. One witness claims to have positive knowledge of a whole park of battle tanks. Another writes of heavy airplane bombs being manufactured by the thousand. Uniforms, boots and field accoutrements for one and a half million men are stated to exist at various depots. If it be true that smoke always indicates the presence of fire, a big underground conflagration must be raging in Germany today.

These circumstantial reports cannot be brushed aside as mere tittle-tattle. In the interests not only of France but of all Europe they ought to be probed to the bottom, and that without delay, for the bare prospect of Germany suddenly taking the field to inaugurate a new Continental war is enough to curdle the blood in the veins of every reflective European.

Possibly, nay, probably, there is a big element of exaggeration in all these stories. My own belief in earlier rumors of German warlike preparations was badly shaken some eighteen months ago, when I was concerned in an unofficial inquiry into reports, circulated by a French ex-Minister for War, of the secret building of submarines and submarine motors at Stettin and elsewhere. We were assured at that time that the hulls of *U*-boats were being fabricated in large numbers at certain industrial centers inland, ready to be railed to the shipyard at Stettin for assembly; further, that German firms, who were named, were building Diesel engines for these boats camouflaged as power-plant machinery.

The result of the investigation which extended over several months, was to prove that the story was absolutely without foundation. No trace whatever was found of submarine hulls, or of anything remotely resembling them, and the motors which were discovered were of such low power as to be entirely useless for propelling submarines.

It is, in any case, hardly credible that the Germans, even the most desperate and least rational of them, would be so foolish as to do the one thing most calculated to bring England into line with France regarding the coercion of their country. Frenchmen argue with some reason, that we on this side the channel would have no more cause to be perturbed by authentic reports of German *U*-boat construction than they have by similar reports of German military rearmament.

"The secret formation in Germany of new regiments or new batteries

of artillery," they tell us, "is as much a matter of concern to France as the secret construction of a new submarine flotilla would be to you. Yet, while you view these well-attested stories of German preparation for land warfare with a philosophic detachment and shrug your shoulders at French 'nervousness,' you are ready to spring up in alarm at the first whisper of anything which appears to indicate the possibility of a German naval revival."

All of which is true enough; but Englishmen can at any rate retort that they are doing nothing to encourage a German naval renaissance, whereas France, by keeping her foot on the neck of the conquered foe, is going exactly the right way to inflame Germany's lust for vengeance.

Everyone outside Germany is agreed that there must be no new war in Europe within the discernible future. But there is, unfortunately, a wide divergence of opinion respecting the best method of avoiding this unthinkable catastrophe.

British opinion on the whole favors a policy of reconciliation. It does not believe that 40,000,000 Frenchmen, even with the aid of their colored levies from North Africa and Senegal, can keep 60,000,000 virile Germans permanently in subjection. The thing is impossible on the face of it.

So long as France is able to support an army of the present gigantic strength Germany, no doubt, will refrain from overt acts of defiance. But for how long will France be able to carry the financial burden of this huge Army? She has thus far maintained it on borrowed money, but some of her shrewdest economists are beginning to challenge the wisdom of this policy, the underlying principle of which is that, as the present generation has borne the burden of a frightful war, the next generation must pay for the security which the sacrifices of its fathers gained for it.

But so far from achieving security, the methods now in operation against Germany seem destined to provoke the very evils they are meant to avert. Has it not occurred to thoughtful Frenchmen that the policy they have hithero supported with enthusiasm may be laying up for their children a heritage of blood and tears?

As Professor Morgan says truly in the lecture referred to above, no country is "disarmed" if, after its war material has been scrapped and its armies demobilized, it has still got lethal secrets up its sleeve.

Germany might reasonably affirm that her consent to the execution of the military clauses of the treaty was conditioned by a reciprocal process of disarmament all around. But nothing of the sort has taken place. On the contrary, she finds herself enveloped in "a shirt of steel." She is hemmed in on all sides by nations great and small, some avowedly hostile, none of them too friendly, and all armed to the teeth.

"Not a single Continental state, except the late enemy states, acting under compulsion, has abolished conscription," Professor Morgan reminds us. "The Germans do not forget this, nor are they allowed to forget it. And so long as they remember it and have reason to remember it, so long will the disarmament of Germany be a relative and hypothetical thing."

JAPAN

Has Japan Become a Second-Rate Power?—By Charles Dailey in *The China Weekly Review*, 20 October, 1923.—Japan, and especially official and commercial Japan, is still dazed by the shock of the earthquake September 1, which laid Yokohama flat, while the fires that followed put five-eighths of Tokyo in ruins and both earthquake and fire destroyed the great naval base at Yokosuka, dealing a blow to the Japanese Navy from which it can hardly recover in the period of the ten years cessation of armament race, as the price of which she was allotted a navy sixty

per cent of the strength of Great Britain or the United States. Many doubted that Japan, in view of her industrial and financial debauch, could continue her naval program. But no one has any doubts now; Japan is out of it. Also she must make gigantic cuts in her army while delaying her naval construction, and at the same time that she is compelled by necessity to reduce her garrisons in Korea and Manchuria she also will be forced to cease the pouring of hundreds of millions of yen annually into what her imperialists have been pleased to term Mansen, as if the Liaotung leased territory was actually hers to couple with Korea and name as she pleased.

It cannot be done. The visitation of September 1 not only caused an economic loss which is still conservatively estimated at ten billion yen, but also, in the opinion of many of her best leaders, has reduced her to the level of a second-rate power, both politically and commercially. In fact, one Japanese of keen intelligence said Japan must now be ranked below Italy. But none of the public men of Japan will admit that she has suffered a worse blow than if she had been defeated in a major war. They are to be admired for their courage, but they all know that Japan sooner or later must admit that she must abandon her policy of imperialism and devote her energies for the next decade, and perhaps for the next generation, to the reconstitution of her own tight little islands. Her power and prestige on the mainland of Asia are gone; her commercial advantages there are threatened. It is no occasion to gloat, but to sympathize.

Retrenchment is the cry that is echoing through the ruins of the departments in Tokyo while the soldiers are busy dynamiting the walls that are still standing and clearing away the debris that in spite of the huge funeral pyres yet contain the bodies of many dead, as is evidenced by the odors. Parliament probably will be convened in emergency session to provide the necessary money for reconstruction. It cannot be obtained by raising the taxes, for these already are a burden upon the people and in addition many items have been put on the free list because of their requirement for building purposes, and this loss of revenue also must be made up. Billions of yen must be borrowed in foreign markets to rebuild her cities, restore her communications and reconstitute her industries. The interest alone on this borrowing, not to mention amortization, will add further millions to the annual impost on the people. Japan must retrench and retrench severely. She can only do it by lopping off her contributions to her colonies, reduce her navy below the limit set at Washington and confine her army to the strict duties of a home defense organization. If the star of Imperialism has not set, then at least the Rising Sun must halt in its ascendency toward the meridian. It is a gloomy view—an unpleasant one for Japan—but it must be looked squarely in the face.

Japan had overstretched herself even before the earthquake. The day of reckoning was almost at hand. The war with Russia in 1904 was the birth of the New Japan; the visitation of nineteen years later stripped her of her veneer of solidity, exposed the inflated skeleton on which she had reared her unsubstantial structure—left her as bare as the day before Admiral Togo sailed out of Shimonoseki Strait in search of the Russian fleet. "I come to bury Caesar; not to praise him," said Marc Anthony. Let us, then, look at matters quite frankly, just as the Japanese themselves will do as soon as they recover from the shocks, and they are still going on nearly forty days later.

The Bureau of Finance has held up the mirror and has fixed the budget for the year 1924 at less than a billion yen. To accommodate the new charges that must be added there must be slashes of the estimates. The retrenchment will reach into every department of the government, even to

education, which is a hard blow to the Japanese, especially with one of her chief universities a ruin and hundreds of her schools gone. It is ordered also that enterprises already launched be curtailed within the limits of possibility or else entirely or partly postponed. All government undertakings hitherto undertaken but rendered impossible or next to impossible by the disaster are to be suspended indefinitely. The plan of issuing loan bonds associated with government enterprises and the promised aid to the entrepreneurs in the South Manchuria railway zone and elsewhere is to be thoroughly revised. Expenditures rendered necessary by the calamity will be estimated as a supplementary budget. Everything else will be pruned to the quick.

"Give till it hurts" was the cry that sold Liberty Bonds in the United States during the World War. Japan—all Japan—must invent a similar slogan. Perhaps it will be: "Save if you omit one meal a day," for the necessity is great and the patriotism of the Japanese is not to be excelled anywhere. Thrift is the urgent necessity. Japan's borrowing power in the present situation is limited by the ability of her people to restrain their expenditures. The cry of "Homeland first!" soon will be raised; Imperialism, Mistress-of-the-Pacific boasts, Asia-for-the-Asiatics cries have passed into the limbo of the forgotten past. It is a New Japan indeed—blanched by earthquake, purified by fire. An entire world even cumbersome, ungovernable China—will lend a helping hand to the New Japan. There will be no recriminations, no I-told-you-so; the past is buried in the ruins, the ashes scattered by the winds that followed. Yet Japan must take the first step herself, as she certainly will do.

The day of reckoning was near at hand even before the catastrophe. Japan had been unable to deflate from the expansion that succeeded the orgy of reckless spending which followed the easily-won gains that the treaty of Versailles ratified. For the further enrichment of her narikins and the wild reaching out for imperialism she had been borrowing sums abroad at as high as ten per cent interest and the government at the time of the disaster was doing its best to restrain this borrowing as it was continuing the high range of prices. The country had not recovered from the panic of April, 1920, due to overbuying by the people and overextension by the banks. The latter were at the time of the visitations carrying huge quantities of real estate taken when loans were defaulted. These, owing to the lax banking methods in force in a country where there are 3,000 banks and only two bank examiners, were still being carried on the books as loans, so the showing of the banks is not actually what it appeared. Bank deposits represented but five per cent of the supposed wealth of the country. Except for thirteen great banks, which held the bulk of the deposits on September 1, eight of these being in Tokyo and five in Osaka—and a number of sound commercial banks like the Yokohama Specie, the banks are severely strained, as presently will be revealed when settling-days come. Hundreds of the smaller banks will be unable to survive.

The total reserves of Japan are estimated to be 1,600,000,000 yen, of which yen 600,000,000 were held abroad at the time of the earthquake. The total damage caused by the disaster is estimated at ten billion yen. The insurance loss in Tokyo alone has been placed at two and a half billions, while less than half the losses suffered are covered by insurance. The British re-insures, holding eighty per cent of the reinsurance, decided early that they would not pay, as the fires plainly were the result of the earthquake. The Japanese insurance companies frankly admitted that they would become bankrupt if they paid more than six per cent of the losses.

A proposal has been made that if the state will grant the sum of 100,000,000 yen, the insurance companies will pay up to the amount of their capital. Even this may not be done, as the matter is being left to a referendum of the stockholders. It is admitted that most of the fire insurance companies in Japan were of the fly-by-night order since the country has been lacking in strict regulations regarding financial operations. This is one of the reforms that is certain to come as a result of the disaster.

To make matters worse, trade and industry were at low ebb. Only one-fourth the factories were working full time and only about half were going at half capacity. Prosperity existed in the silk market, but in that only. The United States was taking monthly about 30,000 bales, bringing sixty million yen a month into the country, or at least offsetting purchases in America by that amount. The stubbornness of the Tonyo, or silk brokers' trust, in refusing to permit the shipment, even temporarily, from any other port than Yokohama, virtually shut off the exports of raw silk for a full month, caused an economic loss of two thousand yen for every bale that was not shipped. The annual buying capacity of the United States is 400,000 bales of raw silk, and the almost complete suspension of shipments in September and early October, when Baron Den, Minister of Commerce and Agriculture tried to bring the Silk Trust to its senses at the demand of the Silk Association of America caused a direct loss to Japan of the value of the difference between thirty thousand bales monthly and the actual shipments. This deficiency cannot be made good. The silk market could not wait, for the buyers of the great silk-selling stores turned to other textiles, such as poplins, imitation silk and, imitation silk and cotton for the winter trade in the United States.

JAPAN AGAIN REDUCES ALLOWANCE FOR NAVY.—*Washington Post,* 1 December, 1923.—Tokyo, November 30.—Minister of Marine Takarabe, in a statement to the Associated Press today declared that the navy department, like other governmental departments, had again been required to reduce its budget because of the unprecedented appropriations necessary for the reconstruction of Japan's devastated areas.

"In the revision of our naval program, after the Washington Conference," said Takarabe, "we drafted a proposed budget of 278,000,000 yen ($139,000,000) for the fiscal year of 1923, and 279,000,000 yen for 1924. We have now reduced the working budget for this year by 39,000,000 yen and the proposed budget for 1924 contemplates a reduction of 41,000,000 yen, making our expenditures for the two years 239,000,000 and 238,000,000 yen, respectively. Of the total for the two years, 126,000,000 is for ordinary account and 112,000,000 for special account.

"Submarine completed or ordered by July 22 last, were forty-seven.

"Five submarines were ordered thereafter. According to the progam seventeen submarines are to be ordered.

"In the matter of auxiliary ships, in which we have been considerably below the ratio of sixty per cent as compared with England and America, the revised program arranged last year under the direction of the late Premier Kato was to have been completed in 1928. That date now has been deferred. As is well known the construction of auxiliary ships is not restricted by the naval treaty.

"We are writing the individual governments to the effect that the so-called race in auxiliary ship construction was never true of Japan."

UNITED STATES

NEGLECT OF NATIONAL DEFENSE PUTS NATIONAL HONOR IN JEOPARDY.—*The President's Message,* 6 December, 1923.—For several years we have

been decreasing the personnel of the Army and Navy, and reducing their power to the danger point. Further reductions should not be made. The Army is a guarantee of the security of our citizens at home; the Navy is a guarantee of the security of our citizens abroad. Both of these services should be strengthened rather than weakened. Additional planes are needed for the Army, and additional submarines for the Navy. The defenses of Panama must be perfected. We want no more competitive armaments. We want no more war. But we want no weakness that invites imposition. A people who neglect their national defense are putting in jeopardy their national honor.

NAVY NEEDS.—*Washington Post*, 13 December, 1923.—The Secretary of the Navy's annual report carries statements setting forth deficiencies and lack of balance in America's naval establishment that call for such action by Congress as may be necessary to raise the nation's sea forces to the maximum set by armament limitation treaties. That maximum was figured on the basis of equality between the two maritime powers of the first order. Considerations of national defense urge that America's sea armament be held to this maximum.

The report stresses the need for cruisers and other craft to supply deficiencies and establish a needed balance. Congress should address itelf to this subject from the point of view of providing thoroughly for the national defense, and not merely with the desire to cut down estimates.

NAVY WOULD KEEP UP STANDARD OF TREATY.—*Baltimore Evening Sun*, 3 December, 1923.—Washington, December 3.—The American Navy must maintain its standard of strength under the Washington Naval Disarmament Treaty, Congress will be told by the Navy Department.

This will be the principal problem of the Navy Department before Congress—to keep up this country's strength under the 5-5-3 ratio of the naval disarmament agreement.

Under the naval disarmament treaty the United States Navy can build no new battleships for thirteen years, but the pact provides for the battleships for protection against torpedoes and air attack.

The Navy Department holds that this modernization of the Navy is of the greatest importance, so that the United States Navy can maintain its equality with the British and Japanese Navies under the Washington agreement. For this purpose several millions of dollars are being asked of Congress.

The Washington Treaty provides for American equality with the strongest of any of the other nations in aircraft carriers. The conversion of two battle cruisers into aircraft carriers is provided for in the disarmament treaty, and the Navy Department is urging the necessity of immediately taking up this work in order that the United States can keep abreast of this new development of naval warfare. Many more millions of dollars are necessary for the program of converting the battle cruisers into aircraft carriers and also for building aircraft for these carriers.

The Navy is asking for eight cruisers and six submarines. The Washington Treaty placed no limitation on these classes of warships, as no agreement could be reached. The Navy takes the position that it is following the spirit of the treaty, as it desires to maintain only the same ratio in these classes of ships as in the case of battleships.

Cruisers are held to be a vital need to round out the fleet and give protection to commerce. The American fleet is held to be very deficient in respect of cruisers. This country now has ten modern cruisers built or building, while Great Britain has forty-three and Japan twenty-five. Cruisers are essential to the fleet as scouts and as a supporting force for destroyers, as well as commerce protectors.

An important need of the Navy which undoubtedly will come before Congress is the question of naval protection for American trade in China. A business of over $200,000,000 annually is dependent upon the protection of a few small gunboats, mostly obsolete, to guard this country's commerce against piracy and banditry in China, according to the Navy Department.

The Navy Department has asked for six fast light-draft gunboats for patrol work about 1,700 miles up the Yangtse river in China. The American warships being used for that purpose now are principally old gunboats inherited from the Spanish War, or vessels too slow to operate against flood waters. The replacing of these old ships is held to be an urgent requirement, which has the strong backing of the American Chamber of Commerce.

This Government takes the position that there is not a single naval base in the limited States that would serve the American Fleet in time of war. It is planned to provide a real fleet base in the Hawaiian Islands, one in San Francisco Harbor, Puget Sound and New York. Other bases are urgently in need of repair.

The problem of insufficient naval personnel also will be a big question before Congress.

MODERNIZATION OF THE FLEET.—*Army and Navy Journal,* 1 December, 1923.—The subject of modernization of the American Fleet will again be up before Congress. It will be recalled that because the Secretary of the Navy went before the committee with incorrect information as to the time when the British guns were elevated, he decided not to use the appropriations which were made by Congress. There is no doubt that the elevation of the British guns gives its fleet a range that is superior to the battle range of the American Fleet. The difference in the range was not questioned, but the point was made by the British government that the work had not been done since the signing of the Naval Treaty agreement, as stated to Congress.

On this account the modernization of the American Fleet has been held up by the Department despite the fact that the money was available and the naval authorities were justified in spending it. This matter will come up at the approaching session of Congress and the Secretary of the Navy will ask for some expression of approval from Congress under which the work can proceed.

There are other improvements which must be made in the fleet if it is to be maintained at a treaty efficiency. All of the ships, except the three of the *Maryland* type, are deficient in protection against submarine and aerial attacks, and will not be thoroughly qualified to take a place in the battle line until they have had bulges and extra armor worked into them. Furthermore, the mobility of the fleet is hampered by six coal-burning ships which it is proposed to convert into oil burners.

The light cruiser *Marblehead* was launched at Cramps' yard, Philadelphia, October 9, her keel having been laid in August of 1920. As the contract stipulated delivery in January of 1922, she is nearly two years behind the program. It may be another year before she will be put in commission on account of the shortage of funds. The shortage in funds is also delaying the completion of the *Trenton, Memphis* and the *Raleigh.* Aside from the authorizing of new ships, the Secretary of the Navy will urge Congress to speed up the completion of the light cruisers under construction. This and the modernization of the fleet will be the most important demands made by the Department on Congress.

THE BATTLESHIP CHANGES CONTROVERSY.—*Army and Navy Journal,* 24 November, 1923.—The impression has been created in this country that

under the Naval Treaty there is a reasonable doubt as to the ethics and the legality of the proposed changes in our battleships.

A belief seems to be general that the British government has indicated officially an interpretation of the treaty which would be opposed to our right to change the turret gun elevations. No such official action has been taken by the British. The attitude of the French government is sufficiently evident from the fact that they were actually engaged in changing their ships at the time that the controversy over our proposed changes was being given the greatest attention by our press. According to the British naval writer, Mr. H. C. Bywater, the Japanese have made similar changes in their capital ships since the treaty was signed. There is no question of ethics or official protest by a foreign government involved in our changes.

In regard to the legal side of the matter we have a perfectly clear case. The English version of the treaty forbids alterations in the "number or general type of mounting of the main armament." The French version, which is equally authoritative, covers the same point in the following words, literally translated. All changes in the "caliber and number of guns in the main armament as well as all changes in its general plan of installation are forbidden." No other part of the treaty has any bearing on the point in question.

The changes necessary to increase our turret gun elevations are in no sense changes of either the "general type of mounting" or the "general plan of installation." If we proposed to make such changes as installing two turrets in place of one, or moving a turret from the centerline to outboard, or from outboard to the centerline, or raising a turret so as to enable its guns to fire over another turret, we would be acting contrary to the letter or spirit of the treaty. But nothing of this nature has been or is contemplated.

To elevate our guns more than is possible at present we must increase the size of the gun port to prevent its being struck by the muzzle of the gun, increase the size of the well into which the breech is depressed when the muzzle is elevated, and move the position of the ammunition hoist slightly. As Captain Schofield has pointed out, "Nothing would be taken away from or added to the gun mount that would change its type. It is not a change in type of a writing desk, for example, if more room is made under the desk so that a fat man can get his legs where a thin man gets them without any trouble."

We must also increase the length of the elevating screw. This will not alter the type of mounting. To quote the same authority again, "A short broomstick is of the same general type as a long broomstick. Size does not alter type."

The last change necessary is to increase the power of the counter recoil system—the means by which the gun is pushed back longitudinally after it has recoiled from firing. The matter is again one of size and power, and has nothing to do with general type. The same type of automobile jack will lift a Ford or a Lincoln car, though differences of size may be necessary.

American Navy Has Plans for Expansion.—By Hector C. Bywater in *Baltimore Sun*, 19 December, 1923.—London, December 4.—One of the issues to be decided by the Parliamentary election taking place on Thursday is the fate of the naval program which the Baldwin Administration adopted some weeks ago. As this measure had not been submitted to Parliament before the dissolution, it does not as yet possess statutory force. If the Conservatives are returned to power the program will be presented to the new House of Commons without delay and approval asked for a supple-

mentary vote to enable the ships to be laid down early in the new year.

The scheme embraces seventeen light cruisers, together with smaller auxiliary craft, and the Government propose to order ten cruisers at once, with the object of alleviating unemployment in the shipping trade. If, however, Thursday's polling results in a Liberal or a Labor victory, it is very improbable that the new naval scheme will be proceeded with, the Liberals being traditionally averse to any save the most urgent expenditure on armaments, while Labor's attitude toward the national defenses is summed up by the slogan, "Scrap the lot!"

This month will also determine the fate of the American naval program at the hands of Congress. It is understood to contain provision for new construction, the modernization of existing ships, the development of fleet bases and an increase of personnel, all of which are requirements of undoubted urgency.

The shipbuilding plans of the Navy Department are by no means ambitious, calling as they do for no more than eight light cruisers, six submarines and six river gunboats.

As regards cruisers, the necessity of increasing the present force of these vessels is clear to everyone familiar with the current naval situation. Of the three major fleets affected by the Washington Treaty, that of the United States is by far the weakest in modern cruising ships. It has no more than ten of these, compared with twenty-five Japanese and about forty-five British ships.

Many of the British cruisers, it is true, are small vessels, not well suited to ocean work, but they are at any rate very useful for service with the battle fleet, whereas the shortage of similar craft in the United States is so acute that destroyers have to be used as fleet scouts, though they are inefficient substitutes in this capacity.

But it is not only in connection with battle-fleet operations that the light cruiser is indispensable. The seventeen ships of this type which it is proposed to build for the British Navy are expressly designed for the protection of commerce.

In any war of the future the American mercantile marine will be exposed to devastating attack unless there is a sufficiency of fast cruisers to patrol the main highways of the ocean. When the World War opened in 1914 the British Navy had a very large number of cruisers in commission, but, in spite of big concentrations in every suspected danger area it was months before the few German corsairs, such as the *Emden* and *Karlsruhe*, could be rounded up and sunk, and meanwhile they had inflicted heavy loss on British trade.

From this point of view, in particular, expenditure on cruisers is a sound form of national insurance. A few million dollars laid out on such ships in time of peace may save hundreds of millions' worth of national property later on.

Arguments of equal weight can be advanced in support of the demand for six new river gunboats. These ships are intended for service on the Chinese rivers, where piracy, thanks to the supineness of the native authorities, is rampant. Every power that has important commercial interests in China finds it necessary to maintain a flotilla of gunboats for the protection of its nationals and their property.

Such vessels are maintained on the navigable waterways by Great Britain, Japan, France, Italy and the United States, but the American gunboat flotilla consists mainly of obsolete vessels, which are not equal to the work they are expected to do. The *China Weekly Review* published some months ago a very outspoken criticism of these American ships, six in number, including three ex-Spanish gunboats more than twenty-five years old.

Low speed on the one hand or deep draft on the other handicapped all the vessels in the performance of their responsible duties. Three of them, as the *Weekly Review* bluntly declares, are "utterly useless. They have no speed and can only move at high water, at which time they proceed to their winter stations, where, when the water falls, they are usually stuck in the mud. It recently took the *Quiros* seven days, steaming at full speed from daylight to dark, to go from Hankow to Ichang. In short, unless trouble occurs at spots where gunboats are stationed there is vacant hope for any of our gunboats ever getting to the scene except at high-water season."

The paper blames Congress for this state of affairs, pointing out that American officials and civilians in China have for years been agitating for a more efficient river patrol. Yet any disturbance of peaceful traffic on the Chinese rivers means a serious interruption in the supply of raw materials vital to many important American industries, wood oil, a basic element in the manufacture of paint, being but one example among many.

Of six new submarines that the Navy Department is asking for, three are to be large underwater cruisers with a wide radius of action and the other three minelayers. In both types of submersible the United States Navy is notoriously deficient. Excepting the six *V* and *T* boats it has no craft of this description which would be capable of carrying out independent long-range operations in, say, the Pacific.

The bulk of the American submarine flotilla consists of fifty *S* boats, which are short by one to two hundred tons of the displacement that would endow them with ocean-going qualities. The present trend of development is all in the direction of increased size and proportionately increased range.

For the British Navy there is now completing the *X-1*, the largest submarine in the world, whose submerged displacement of 3,600 tons is that of a light cruiser. Japan is building a whole series of 1,500-ton boats and has several 2,000-tonners on the stocks. At least half of the submarines authorized in the new French program will be boats of more than 2,000 tons.

But it can be said without fear of contradiction that to no Navy is the very large submarine more necessary than to the American, whose strategic junctions are so essentially pelagic in character.

Without adequately equipped bases the best-found fleet is, under modern conditions, paralyzed and impotent. Now that the United States Navy is debarred, under the Washington agreement, from developing *points d'appui* in the Western Pacific, it is thrown back upon Hawaii as the only center from which it can exert its power, even defensively, in the waters of that ocean.

According to the most competent naval opinion, Pearl Harbor, Honolulu, does not as yet possess more than half the facilities requisite for maintaining the minimum force that would be based there in the event of war. At the first threat of trouble in the Pacific there is more than a probability that every available unit, from superdreadnaught to submarine, would be rushed to Pearl Harbor, which in a few weeks' time would thus become the headquarters of a mighty armada.

But with only one dock capable of taking the largest ships, with inadequate supplies of oil, munitions and other necessary stores, and with a restricted navy-yard plant for the repair of damaged ships, Pearl Harbor would be in no position to discharge its duties as principal war base of the United States fleet. Confusion, even chaos, would result, especially if the enemy, who would not be ignorant of the state of affairs, took it into their head to inaugurate at that moment a long-rang offensive in the eastern area of the Pacific.

Every argument by which British strategists justify the expansion of Singapore into a fleet base of the first rank could be applied with double force to the development of Pearl Harbor. By reason of its geographical position, practically equidistant from every vulnerable point along the western seaboard of the United States, it is the natural and inevitable hub of defense in that quarter. Unless it is developed on the required scale terrible penalties may be extracted for this neglect at some future time.

One cannot talk to an American naval officer without speedily discovering that, back of his mind, the question of personnel dominates all other considerations. In an emergency ships can be built at relatively short notice and fleet bases improvised, but by no method within human cognizance can trained naval officers and seamen be made available without long years of preparation.

In the last analysis the measure of a Navy's fighting efficiency depends on its personnel, and it is just here that—if a frank criticism may be permitted—the efficiency of the United States Navy is so difficult to assess. Numerically its man power is, at this moment, about equal to that of the British Navy, though the inclusion of the marines—only a small proportion of whom serve on board ship—tends to make the American total seem larger than it really is.

Actually the British Navy has, I think, a slight margin of superiority in the number of executive officers and seamen, including the royal marines, all of whom are trained for duty afloat. But whereas the British enlisted man engages for a term of twelve years, the American bluejacket is bound only for two, three or four years, as the case may be.

There is far more in this discrepancy than may be apparent to the layman. It is the unanimous view of British naval men that six years represents the minimum period necessary for training a bluejacket up to the point at which he becomes a useful member of a ship's company. This long period of training is due to the complexity of modern naval technique, which can only be mastered by years of intensive tutelage.

Judged by the British standard, therefore, an American seaman who had served the maximum term for which he enlisted, namely, four years, would still be only a two-thirds trained rating, while the two-year and three-year men, who constitute a large proportion of every American warship's crew, would be classed as "raw" or "green" ratings who ought not to be employed in firstline ships.

While, therefore, the United States Navy would certainly benefit by an increase in the number of its officers and men, it would gain infinitely more if the legislative authorities could be induced to raise the shortest period of enlistment to six years. Not until that is done will the numerical strength of its personnel be accepted as a safe guide to the American Navy's efficiency for war, so far as the human element is concerned.

MERCHANT MARINE

URGES SHIP BOARD AS PART OF NAVY.—SENATOR WALSH HAS BILL TO PROVIDE ASSISTANT SECRETARY TO OPERATE IT.—*Washington Star.*—As a solution of the United States overseas merchant marine problem Senator David I. Walsh of Massachusetts proposes that the government-owned fleet be made an auxiliary of the Navy.

"I intend to introduce a bill," said Senator Walsh today, "to create the office of second assistant secretary of the Navy and to turn over to him all the powers and duties now vested in the United States Shipping Board and Emergency Fleet Corporation.

"The bill will provide that the second assistant secretary of the Navy, under the direction of the Secretary of the Navy, shall in time of peace

operate all the merchant ships now being operated for the government. He shall have the power to continue the existing shipping lines which have been established with the government vessels and to establish new lines between American and foreign ports as they may become necessary to aid American trade.

"The bill will provide further that the entire personnel of these ships shall become members of the naval reserve and will give the Secretary of the Navy authority to assign for duty on the merchant vessels regular officers of the Navy to such an extent as may be advisable.

"In the event of war or any other national emergency the President shall have the authority, by executive order, to make of the merchant fleet an auxiliary of the Navy.

"The second assistant secretary of the Navy will be empowered to recondition the merchant vessels owned by the government or to sell them to private American interests, as provided under the merchant marine act of 1920, when private American interests find they are able and ready to operate these lines."

Senator Walsh said that in his opinion the merchant fleet could be operated far more effectively and economically with one man in entire charge, as he proposes, than in the hands of a shipping board of seven members. He pointed out that naval officers assigned to duty with the merchant fleet would get valuable experience at sea and that it would be possible, with the merchant fleet as an auxiliary of the Navy to keep down big appropriations for the Navy. He said also that under his plan the United States would have a well trained naval reserve, which would be of great value in time of war.

UNCERTAINTY OF PERMANENCY INJURIOUS TO SHIPPING BOARD.—*The Nautical Gazette,* 1 December, 1923.—On his return this week from a European tour Chairman Farley, of the Shipping Board, issued a statement to the effect that the uncertainty which prevails today as to the permanency of the American merchant marine was proving injurious to the development of our shipping. He avers that the rumors constantly spread abroad concerning the ephemeral nature of American steamship services are preventing vessels of United States registry, whether privately or Government owned, from attaining the proper amount of success in booking passengers and freight from and to European points. This doubt as to the continued existence of the American merchant fleet is also upsetting to foreign shipping companies, which are kept guessing as to the rôle this country intends to play in the overseas trade, and as to the amount of competition to be faced ultimately from vessels under the Stars and Stripes. All such doubts as to American tonnage remaining on the seas permanently and in adequate volume to take care of our essential foreign trade requirements could be removed, Chairman Farley thinks, by the adoption of a definite shipping policy to the working out of which he intends to devote his best energies from now on. He should realize, however, that the virtual monopoly of the leading trade routes enjoyed by Shipping Board tonnage is mainly responsible for the misgiving felt in Europe and elsewhere regarding the durability of American flag services. Shippers are aware that the Government's merchantmen are deteriorating in efficiency from year to year, and that no steps are being taken to replace them with more up-to-date vessels. The time is not far distant when the majority of the Emergency Fleet Corporation's freighters will have passed their prime. They will then be unable to compete effectively with the newer types of boats being turned out in foreign countries and will cease to be a serious factor in the world's carrying trade. The adoption of a new policy by the Shipping Board or a change in its operating methods will not remove the existing

distrust of the permanence of American shipping services conducted for the most part with Government tonnage. Confidence that they will last can only be established, however, by the Government retiring from the shipping business and allowing private vessel owners to serve the different trade routes to the best of their ability.

Opening of World's Largest Dry Dock.—*The Nautical Gazette*, 17 November, 1923.—St. John, N. B., November 5, 1923.—On October 29 the world's largest dry dock was opened at this port by Lord Byng, the Governor General of Canada. The opening ceremonies were attended by a large number of distinguished guests among whom were many prominent parliamentary leaders and representatives of trade and industry. Among the speakers were Sir Douglas J. Hazen, Lieutenant-Governor Todd, Hon. Dr. J. H. King, Premier Veniot, Sir Henry Thornton, head of the Canadian Government Railway System; the Honorable F. B. Carvell, chairman of the Board of Railway Commissioners of Canada, and Grant Hall, vice-president of the Canadian-Pacific Railway. Several representatives of the shipping industry also attended, among whom were Sir Joseph Isherwood, the inventor of the Isherwood system of ship construction; James French, chief of staff of Lloyd's Register for the United States, Canada and South America; R. W. Bruce, naval architect of the U. S. Shipping Board, Washington, D. C.; E. P. Morse and A. D. MacCorkindale, representing the Morse Dry Dock & Repair Company.

The entire dock is cut out of the solid rock and measures 1,150 feet on the blocks, with breadth of 125 feet and a depth of water over sill of forty-two feet. It is equipped with two caissons, the inside section of the dock being 500 feet and the outer docking section 650 feet long. There are also ten fifteen-ton capacity electric capstans, one fifteen-ton traveling crane with a lifting capacity of twenty tons at an eighty-foot radius, useful at any point throughout the dock; one eighty-ton fixed derrick at fitting-out wharf lifting five tons at a sixty-five-foot radius; a fire protection system, and electrically operated pumps for emptying the dock.

A slipway is provided beside the dock entrance which will take any vessel up to 250 feet long with a deadweight not in excess of 1,800 tons, which consists of a cradle on a wide gauge inclined track extending to below low tide. The docks have a separate sewage system so that vessels may have all repair work done without any interruption of the usual wastage discharge. This is stated to be an innovation and an advantage over most modern docks.

The dry dock is equipped with the most modern pumping methods, an electric dock lighting equipment, a dock telephone system, a supply of compressed air, and a water pressure available at any point of the dock. The power house contains a battery of four 500 h.p. Robb water tube boilers equipped for firing with crude oil. These boilers settings are so arranged that mechanical stokers can be installed on short notice. The fuel oil supply is stored in reinforced concrete tanks with a capacity of 50,000 gallons. There is a regular layout of shipyard shops and tools, and an up-to-date repair equipment to carry on with a force of five thousand men.

On the very day of its opening the St. John dock had an opportunity of demonstrating its usefulness when the steamship *M. H. Kongshavn* was brought into port after having been ashore on Brier Island off the Nova Scotian coast. She was the first vessel to cross the gate of the dock for survey and repairs.

The new dry dock is located on Courtenay Bay, an arm of the well

known Bay of Fundy. While the latter is noted for the great rise and fall of its tide, the variance between high and low water mark at St. John dry dock is only about twenty-four feet. This cannot be deemed excessive when its splendid approaches and breakwaters are taken into account.

The *Majestic, Leviathan, Berengaria* and other great liners could easily be accommodated in Courtenay Bay without being cramped for space in any way. An added feature of importance is the fact that St. John is an open port all the year round, enjoying railroad facilities of the most modern type, and the backing of the Canadian Government with the unlimited resources of the Dominion of Canada behind it. On account of its accessibility at all seasons and its advantageous location, the port and its dry dock can look forward to a great future. Negotiations are now under way to dry dock several of the largest trans-Atlantic liners at St. John in 1924.

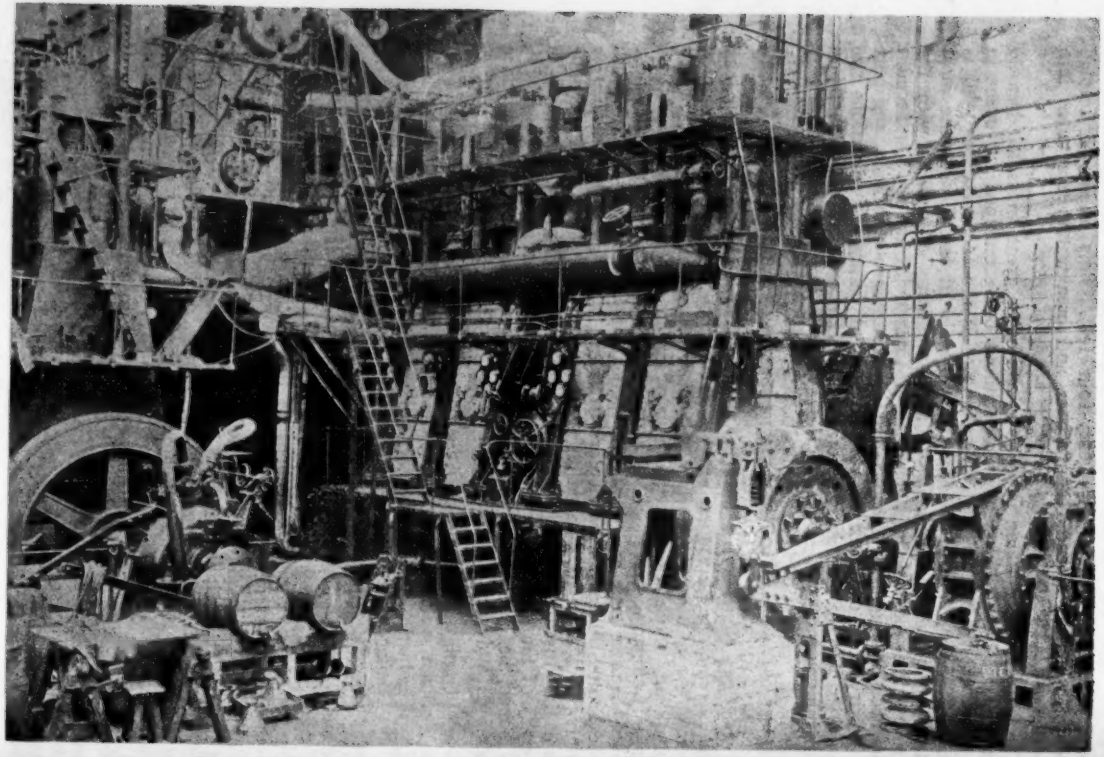
ENGINEERING

THE FIRST SCOTT-STILL MARINE ENGINE.—*The Marine Engineer and Naval Architect,* December, 1923.—The Scott-Still engines are now complete for a new cargo liner which is being constructed by Scott's Shipbuilding & Engineering Company, Ltd., Greenock, for Alfred Holt & Company, Liverpool. Particular interest centers around these engines, because they are the first practical application for marine work of the Scott-Still engine, particulars of which were given in *The Marine Engineer* of March, 1922, based on a paper read by Mr. Archibald Rennie, before the Institution of Engineers and Shipbuilders in Scotland in February of that year. The new ship, which has been named *Dolius,* will, it is hoped, be launched within the next few months, and she will have dimensions and particulars as follows:

Length	400 ft.
Beam	52 ft.
Depth	32 ft.
Displacement	11,650 tons.

The main propelling machinery is to consist of two sets of four-cylinder Scott-Still marine engines, working on the two-stroke cycle and scavenged by one steam-driven turbo-blower. We illustrate on succeeding pages an elevation and sections of this engine, and also a machinery lay-out of the vessel herself.

The main engines have each a bedplate length of 24 ft. and a width of 9 ft. 3 in. The height from top to crankshaft center is 20 ft., and the weight is about 134 tons, including piping. The cylinders are 22-in. bore and 36-in. stroke, and the engines give 2,500 b.h.p. at 120 r.p.m. This horsepower equals a brake mean effective pressure of 75 lb. per sq. in., and is obtained with an indicated combustion mean effective pressure of 79 lb. per sq. in. The power needed to drive the scavenge blower overcome engine friction and balance the combustion indicated horsepower against brake horsepower, is obtained from steam generated by heat wasted by the combustion cycle. The steam is generated at about 140-lb. pressure and is first employed at the back of one of the combustion pistons, acting as in a high-pressure cylinder: it then passes to the other three cylinders, which act as one and effect a further expansion; during these expansions the steam picks up heat in cooling the combustion engine pistons and passes to the low-pressure turbine fitted on the blower shaft. This gives a three-stage expansion to a final pressure equal to about a 28-in. vacuum.



THE FIRST SCOTT-STILL MARINE ENGINE

Starboard set of Engines on the test bed for the new Holt line *Dolius*, building by Scott's Shipbuilding and Engineering Company, Ltd., Greenock.

Extra steam can be generated by the use of oil burners under the boiler, and the power developed thus increased to about 3,000 b.h.p. at normal revolutions. With these burners alight, the engine can run constantly on steam only at a minimum speed of 20 r.p.m. and can attain a speed of about 60 r.p.m. against the resistance of the propeller. Combustion can commence at about 30 r.p.m., and the engines will run constantly on combustion alone at less than 40 r.p.m. The range from twenty to 135 r.p.m. (which is the highest at which the engine has been tested) can therefore be amply covered by the engine functioning at the start as a steam engine, which is subsequently aided by combustion within the cylinders, the steam power being reduced to waste heat proportions as soon as the engine steadies into normal operation.

The steam valves are (in this set of engines) operated hydraulically by pressure oil supplied by an electrically-driven Hele-Shaw pump which automatically maintains a constant pressure. Each engine is fitted with a rocking beam which operates all the remaining pumps including an Edward's air pump for maintaining the vacuum in the steam system.

The cylinders are of the special Still construction of cast iron, in one piece with the combustion head, which contains a single hole for the injection valve; the cylinders are only 5/8 in. thick, and have longitudinal ribs reinforced by forged steel hoops which take the bursting stresses, and the thinness ensures that the heat stresses are a minimum. The jackets are steel castings, arranged to withstand the boiler pressure inside; the tops of the liners carrying the jets pass through stuffing boxes in the jackets, and thus allow free expansion.

The crankshaft is of the semi-built-up type, in two two-throw halves, with a flanged coupling in the center; the two halves are interchangeable, and the extra flange at the forward end is used to carry a fly-rank which drives a rocking beam from which are driven auxiliary pumps for the steam side, as will be seen.

The combustion side operates on the two-stroke cycle with port scavenge, fuel being injected on the "solid injection" principle. It is interesting to note that since no compressed air is required for this purpose, and moreover, since starting is effected by steam, no high-pressure air compressors, storage bottles or auxiliary engines are required in the installation.

The combustion cycle is what is sometimes known as a dual cycle, in that it is part of constant volume combustion and in part a constant pressure combustion, the oil being admitted rather before dead center. This idea has been adopted owing to the much lower compression pressure possible than in a Diesel engine; a compression pressure of only 300 to 320 lb. per sq. in. is ample owing to the hot jackets and walls of the Still engine, to ensure ignition even when starting from rest, while the maximum pressure is of the usual order. This fact is of great importance, since the risk of excessive pressure in the cylinders is eliminated.

The fuel valves or jets are automatic in action and open by the pressure of oil in the fuel pipe, timed by the pumps. The oil fuel pumps (1¼-in. bore) are situated on the bed of the engine and operated by cams on the crankshaft coupling. The amount of oil delivered to the engine is varied by spill valves which open earlier or later in the pump stroke as desired, not by varying the stroke of the pump or the lift of the suction valves. The opening of the spill valves is controlled by hand, and a governor is fitted to limit maximum speed and prevent racing.

Reversing is accomplished by sliding the pump cam rollers sideways to engage either with the ahead or astern cams, which are side by side on the shaft.

The scavenge air for both engines is supplied by one turbo blower set,

THE FIRST SCOTT-STILL MARINE ENGINE
Starboard set of Engines on the test bed for the new Holt line *Dolius*, building by Scott's Shipbuilding and Engineering Company, Ltd., Greenock.

built by Brown-Boveri & Company, driven by an exhaust steam turbine taking steam after it has passed through the main engines on its way to the condenser. This has a capacity of 12,000 cubic ft. of air per minute and delivers air at a pressure of 235 lb. per sq. in., running normally at 3,800 r.p.m. On the same shaft is also coupled an electric motor (220 volts), which serves to drive the blower in case of accident to the turbine, or to assist the turbine, either when insufficient exhaust steam is available or when for any cause the vacuum is low. There are thus two alternative methods used to generate steam; water is led by natural circulation down from the water drum of the boiler to a junction piece, whence the pipe divides and leads up through the four small generators into the bottom of each cylinder jacket. After passing through the jackets, the water, now highly charged with steam, is collected into a common pipe and led back to the top drum of the boiler, where the steam separates out.

Two burners are fitted in the furnace front of the boiler and utilize the water tubes (882 sq. ft. heating surface) for raising steam initially or for generating additional steam for maneuvering or for overload. In the event of complete breakdown of the combustion engines, these boilers are capable of propelling the ship at reduced speed.

The feed water from the hot-well is pumped through special (duplicate) oil filters, as much lubricating oil as possible being extracted from the steam in an exhaust steam separator, fitted between the engine and the scavenge air turbine.

The steam so generated is used expansively on the underside of the combustion pistons. Under ordinary running conditions the after cylinder acts as a high-pressure cylinder and the remaining three as intermediate pressure cylinders, the steam finally being expanded right down to about 28-in. vacuum in the low-pressure turbine which drives the scavenge turbo-blower. It should be noted that the mean pressure indicated on the steam side of the engine cylinders is that of two expansions only, the third expansion not appearing as indicated power. The condenser is of the usual marine surface type, and one serves both engines, with a tube service of 1,000 sq. ft.

For starting and maneuvering all four cylinders act as high-pressure cylinders. The steam is admitted to and exhausted from the engine cylinders by piston valves 3½ in. diam., located in the steam covers, there being in each cover three similar valves, one admission and two exhaust. These are operated by oil pressure at 400 lb per sq. in., controlled by a distributor and supplied by a Hebe-Shaw variable delivery pump driven by an electric motor. There is a second pump set in reserve, one pump being capable of supplying the oil for both engines, the power absorbed on the one engine being just under seven e.h.p.

Control is centered in one large hand wheel and the steam stop valve. Rotation of the hand wheel, in one direction, is for ahead and in the opposite direction for astern running. The first few degrees of movement in either direction set the fuel pump rollers on the correct cams; the second step further admits steam under the pistons with a long cut-off; and the last step shortens the cut-off to the normal running condition and allows fuel to be injected into the combustion cylinders. A handle on a quadrant adjusts the quantity of fuel admitted at each stroke, and a similar one sets the speed at which the governor cuts out the fuel, the two being interlocked. A separate handwheel changes the steam system from compound running to simple expansion or *vice versa*.

We append a complete list of the main engine auxiliaries.

The following are driven by the engine from the forward end flange of the crankshaft by a rocking beam:

One condenser air pump, 14-in. bore by 15-in. stroke; one boiler feed

pump, 2-in. bore by 7-in. stroke; one forced lubrication pump (D.A.), 4.75-in. bore by 7-in. stroke; one bilge pump,* 6.3-in. bore by 7-in. stroke; one oil separator drain pump, 3½-in. bore by 3¼-in. stroke; one boiler filter pump, 7-in. bore by 7-in. stroke.

The following are separately driven:

One Hele-Shaw variable delivery pump, driven by an electric motor for supplying lubricating oil at 400 lb. pressure for operating the steam valve hydraulic system of both engines; power for one engine, about 7 e.h.p.

One condenser circulating water pump,* one electrically-driven centrifugal pump for both engines.

One burner fuel pump.

There are also the following stand-bys:

A duplicate valve gear oil pump and motor, and steam-driven Weir feed pump, a steam-driven forced lubrication pump, and an evaporator.

The following summary figures are typical of full load trials carried out by the builders:

Average combustion, m.i.p.	77.8 lb. per sq. in.
Average steam, m.i.p. (referred to the combustion swept volume)	6.6† lb. per sq. in.
Total m.i.p.	84.4 lb. per sq. in.
Mechanical efficiency	122.
R.P.M.	1,425.
Total i.h.p.	1,251.
Brake h.p.	87.8 per cent
Oil consumption per b.h.p./hour	0.356 lb.
Steam evaporation per hour	2,400 lb.

*Not working on shop trials.

†This does not include the third stage expansion in the low-pressure turbine, driving the scavenge blower.

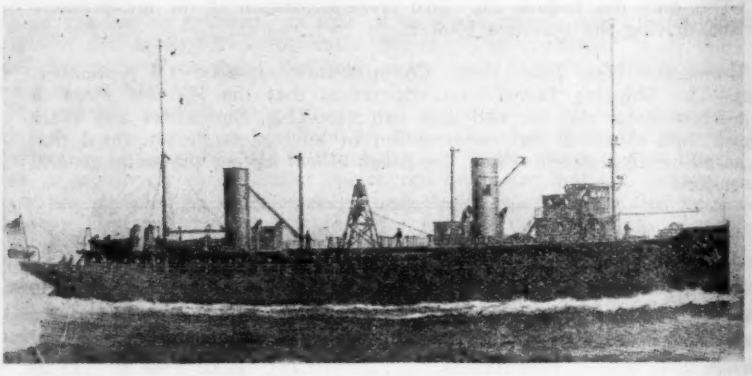
MOTORSHIP HAS LOW FUEL CONSUMPTION.—*Power*, 13 November, 1923.—The Shipping Board's records reveal that the *William Penn*, a twin-screw motor ship engined with two 2,100-i.h.p. Burmeister and Wain Diesels, had shown a fuel consumption of approximately one-third that of an oil-burning steam vessel, the *Ethan Allen*, having the same general dimensions.

	Ethan Allen	*William Penn*		
Voyage number	54	1	2	3
Number of ports called	21	18	15	18
Days at sea between pilot stations	88.7	109	104	96
Total distance steamed	22,951	27,769	26,977	28,317
Average speed between pilot stations	10.78	10.65	10.83	11.29
Total fuel at sea	3,220	1,419	1,394	1,395
Total fuel in port	1,059	93	106	73
Total fuel, sea and port	4,279	1,512	1,500	1,488
Miles a ton of fuel	7.12	19.6	19.3	20.29
Average daily fuel at sea, tons	37.47	13.04	13.04	14.53
Average daily fuel in port, tons	.....	29.79	.75	1.08
Average daily fresh water	9.9	2.4	3	2.16
Total cost voyage repairs, engine room	$3,501	.....	.....	$112
Total cost voyage repairs, deck machinery	.....	$393	.....	.....

The comparison shows that on a ton of fuel the *William Penn* can cover two and three-quarter times the distance covered by the *Ethan Allan*. Unfortunately, the steamer's recorded port consumption is unusually high due to the necessity of maintaining steam pressure for emergency purposes while in Oriental ports. This is not required by the motorship, and a direct normal comparison, therefore is not possible. It may be stated, however, that fuel port consumption of the average steamer is from ten to twelve times that of a motorship.

It must be admitted that the foregoing comparison leaves no doubt as to the substantial savings in fuel, water, engine-room wages and subsistence realized by the motorship, not to speak of other indirect advantages such as increased cargo capacity and greater flexibility of operation with consequent smaller operating expenses. As the sale of good hulls at a nominal price makes possible their conversion at a cost but little higher than newly built foreign steam tonnage and much less than foreign-built motorships, it follows that by the possession of high-grade vessels of low initial cost, the American shipowner is at once placed in the privileged position heretofore enjoyed by his foreign competitors.

NEW ARMY ELECTRIC DRIVE DREDGE.—*The Nautical Gazette*, 24 November, 1923.—A notable event in the American shipbuilding world was the launching this week at the yard of the Sun Shipbuilding Company of two new seagoing dredges which are the first all-electric craft ever built. Constructed for the United States Engineer Corps these Diesel-electric driven hopper machines with the molded hull of a ship may mark a beginning of a new era in methods of vessel pro-



pulsion. On them electricity is used for operating the auxiliary machinery and all cooking, heating, ventilating, and lighting apparatus, while their Diesel engines, instead of driving the propeller, set an electric generator in motion which in turn furnishes power to motors connected with the propeller. These dredges represent a definite advance in naval architecture, and their performance when in service will be followed with great interest by all shipping men. As it is the intention of the War Department to publish from time to time the operating results of these vessels, American shipbuilders and vessel operators will be in a position to obtain authentic data regarding the working in actual practice of the latest and most modern method of propelling ships. This opportunity to test the

most recent development in marine engineering is due to the initiative of our army engineers who have always been ready to try out new and promising improvements in the marine field. They are more fortunate in this respect than the Shipping Board which, although it has ample funds on hand, lacks the authority to construct vessels of a novel type and to further this country's advance in the art of shipbuilding.

A NEW MOTOR THAT PUTS THE "IDLE CURRENT" TO WORK.—*The Literary Digest*, 1 December, 1923.—A new electric motor of the induction type, which is able to utilize practically the whole of the current turned into it, instead of only about fifty to seventy per cent as with earlier forms, has been invented by V. A. Fynn and Hans Weichsel of the Wagner Electric Corporation, St. Louis. Induction motors have always required to operate them from thirty to fifty per cent of so-called "idle-current," which does no useful work. The new Fynn-Weichsel motor has a "power-factor" of practically 100 per cent according to the inventors, and will thus reduce operating expenses in the United States by about $100,000,000 annually. The necessity for a motor of this kind has long been recognized, and in 1921 the National Electric Light Association passed a special resolution inviting manufacturers of electric motors to concentrate upon the problem.

Says *The Electric World* (New York):

"The motor is a combination of a synchronous and an induction motor. The machine starts like a polyphase induction motor of usual design. It is held in synchronism by a suitable direct exciting current generated in the machine itself, and until such time as it becomes overloaded. As the synchronous motor 'breaks down' the induction-motor action automatically steps into the breach, and the machine continues to operate as an induction motor. This transition is smooth and not readily detected by the casual observer. When the overload disappears, the motor again steps back into synchronous operation. By different settings of the brushes the power-factor can be adjusted to suit widely varying condition."

In a later issue the same paper reports the following interview with W. A. Layman, president of the Wagner Corporation:

"'Is this motor a recent development or was it previously conceived and just announced as a commercially available machine?' Mr. Layman was asked. 'We have been working in this field for many, many years,' he replied, 'but until a comparatively recent date the burden of poor power-factor was not sufficiently appreciated by the distributing companies for them to be interested in the commercial development of a unity-power-factor motor. Then, too, the war, with the accompanying demand for quantity production of war supplies, sidetracked special development work, although power-factor corrective apparatus was even then greatly needed to release idle equipment for productive purposes. Since the war the conditions of the reconstruction period, while difficult, have permitted a resumption of development work, and this motor in commercial form is the fruit of the resumption of our development program.

"'Then, too, there has been a radical change in the central-station situation with respect to power-factor correction. Dating from the 1921 convention of the National Electric Light Association there has been a continuous and an urgent pressure from the Technical Section of the organization for the development of unity-power-factor motors, and the acceleration of our development program may be directly traced to this vigorous encouragement from that source.'

"'Is the saving possible through power-factor correction really as stupendous as you were quoted as saying in the newspapers?' Mr. Layman was asked. As supporting evidence, he referred to a detailed study on

one large utility company's system which sustained $485,000 a year alone.

"'These figures refer to only one system,' Mr. Layman explained. 'The total central-station investment in this country is approximately five billion dollars, and if it be assumed that the central-station industry as a whole is not operating under more favorable conditions than this one large unit, it will be seen that the broad statement made in some of the newspapers to the effect that there is a billion dollars of idle plant investment growing out of low-power-factor operation is not a wild flight of the imagination. When the fundamental economic conditions so strongly cry out for a corrective device such as this new motor, it may be taken for granted that practical policies insuring its rapid adoption will be adopted by the industry. What these policies are to be with respect to central-station practice is naturally a question for time to determine. It is our anticipation, however, that the near future will see a definite clarification of policy with respect to this question on the part of central-station companies along lines which will offer an incentive to the employment of this new type.

"'It must also be taken into account that the corrective effect is applied by the new motor at the source of the trouble. This is not generally true with other means heretofore employed. So the operating savings are larger. The new motor involves no sacrifice of space, which will in many instances be an important factor, and does not in any way increase the chance of accident or injury to plant operatives over that with the older types of motors.'"

Editorially *The Electrical World* makes the following comment on the achievements and possibilities of the new motor:

"It is with more than passing interest that the electrical fraternity will view the recently announced 'Fynn-Weichsel' motor, or 'self-excited synchrononous induction motor.' Its characteristics indicate it to be a practically fool-proof machine of the induction-motor type. This development may have much bearing on a major problem of the industry, and the industry will be quick and glad to accord credit to those who have developed it. And, furthermore, if it proves in commercial practice to be accepted by the industry at large, there will doubtless result interlicensing arrangements such as have followed many other notable achievements in the industry.

"Of course no piece or combination of equipment offers the full solution to the power-factor problem, and the aim must always be toward a fundamental basis of solution, which is to have the user install correct equipment if it can be provided and not merely corrective equipment."

AERONAUTICS

REPORT NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.—. . . . Conclusions.—During the past year there has been a gratifying increase in knowledge of the science of aeronautics, as fully described in the reports of the technical subcommittees and in the various publications of the National Advisory Committee for Aeronautics. A year or more must usually elapse before the results of fundamental research become evident in the construction of better aircraft. Justification of the policy of continuous prosecution of scientific research is reflected in American achievements of more popular interest during the past year, among which may be mentioned the following:

(*a*) The five-day test demonstration by the Air Mail Service of the practicability of night flying of the mails, resulting in the transportation of mails across the continent in both directions in from twenty-seven to thirty hours.

(*b*) The completion of the first rigid airship to be built in America, the Navy fleet airship U.S.S. *Shenandoah*, formerly known as the *ZR-1*, which has successfully passed the preliminary tests and which promises, under handling, to furnish reliable information as to the safety and practicability of airships in warfare using helium instead of hydrogen, and which may serve to open up a new era in air transportation and establish a new industry in America.

(*c*) The winning by the American Navy, in international competition, of the Schneider cup for naval seaplanes, when an American naval seaplane made a speed of 177 miles per hour, which was twenty miles per hour faster than the nearest competitor of any other nation, and thirty-one miles per hour faster than the speed of the winning British seaplane the year before.

(*d*) The nonstop flight by the Army Air Service across the continent from coast to coast, or 2,520 miles, in twenty-seven hours, in a *T-2* airplane in which the Army had previously established the endurance record of thirty-six hours.

(*e*) The establishment by the Navy in the Pulitzer trophy contest of a new official world's airplane speed record of 243.67 miles per hour over a four-lap triangular course of 2000 kilometers, an increase of thirty-seven and eighty-seven hundreds miles per hour over the winning speed of the year before; and the subsequent establishment of a record of 266.6 miles per hour over a straightaway course of 3 kilometers.

(*f*) The remarkable demonstration of popular interest in aeronautics on the occasion of the annual air races held in St. Louis, October 4-6, 1923, when, according to reliable reports, 150,000 people attended and 300,000 miles were flown in connection with the meet without casualty.

These visible evidences of progress during one year compel recognition of the fact that America, although spending less money on aviation and maintaining smaller air services in the Army and Navy, is nevertheless abreast of other nations in the physical development of aircraft. There has, however, been but little application of existing knowledge of aircraft, or air navigation, to commercial purposes. Broadly speaking, the situation with reference to the lack of commercial flying may be summarized as follows:

(*a*) Only when reliable service at reasonable cost can be given will American business men be ready for commercial aviation. Progress must be gradual. It must rest upon a sound economic basis. Despite the remarkable physical development of aircraft, the present high cost factor, combined with the absence of improved national airways, constitutes an economic barrier to the general application of aviation to commercial purposes.

(*b*) There has been no Federal legislation and but little State legislation to encourage the development of commercial aviation.

The continuous prosecution of scientific research on the fundamental problems of flight by the National Advisory Committee for Aeronautics, and the systematic collection and dissemination of technical information from all parts of the world, assure progress in the development of aircraft. Although necessary, these activities alone are not sufficient to assure the early introduction of aviation into commercial pursuits generally.

Costs must be reduced, but to accomplish this the development of commercial aviation should be given greater encouragement than it now receives from the Government. The present ten-year aircraft building program of the Army Air Service and the five-year program of the Navy will, if carried out, meet the absolute needs of the two services, and possibly serve to keep in existence a nucleus of an industry until a strong, self-supporting commercial aircraft industry develops.

While there is serious question as to whether commercial aviation can or should be permanently maintained by the Federal Government, it is certain that it cannot get an early start without assistance. The practical development of aviation in America will not be realized until the Government gives intelligent support and effective aid, principally by regulating and licensing and by co-operation with the States in the establishment of airways and landing fields. The Committee accordingly reaffirms its oft-repeated recommendation for the establishment of a Bureau of Civil Aeronautics in the Department of Commerce.

The committee also strongly recommends liberal appropriations for the development of aviation in the Army and in the Navy. At the present time the Army Air Service is equipped largely with obsolete war-time airplanes and engines. These aircraft are being rapidly exhausted, and at the present rate of appropriations the supply of equipment will become more inadequate each year. The Navy is also confronted with a serious shortage of aircraft. Bombing exercises have taught the lesson that aircraft are absolutely necessary for mobile coast defense, and that a Navy without adequate aircraft will be at a hopeless disadvantage in future warfare. Major warships are being equipped with aircraft, but at the present rate of appropriations, after making due allowance for necessary replacements, the fleet will not be equipped with the proper proportion of aircraft.

Whatever may be the demands of economy, serious consideration must be given to the increasing relative importance of aircraft in warfare and funds appropriated to equip and maintain adequately the air services of the Army and Navy. Progress in aeronautics is being made at so rapid a rate that the only way to keep abreast of other nations *is actually to keep abreast*, year by year, *never falling behind*.

Respectfully submitted,

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS,
JOSEPH S. AMES, *Chairman Executive Committee.*

ARMY PILOTS TO FLY AROUND THE WORLD.—*U. S. Air Service*, December, 1923.—The Secretary of War has approved the project submitted by Major-General Mason M. Patrick, Chief of Air Service to send a flight of four or five Army airplanes around the world during the coming spring and summer months to demonstrate the feasibility with which aerial communication may be established between the various continents and to obtain desired information concerning the operation of present type aircraft in various climates.

The route of the flight will not be definitely determined until authority has been received from all of the foreign Governments whose territorial rights are involved. The Department of State is conducting correspondence on the subject with these Governments. The tentative plans for the flight are as follows:

Leave Washington, D. C., about the middle of March and proceed to Seattle, Wash. Depart from Seattle about the first of April, 1924, flying northward along the coast of Canada and southern Alaska; across the Aleutian Islands; down through the possessions of Japan; along the shore of China, French Indo-China, Siam and Burma; across India; up the Perian Gulf; across Turkey and Europe to England; thence north through the Faroe Islands to Iceland; thence to Greenland and southward along the eastern shore of the continent to Cape Farewell, Greenland, from which point a direct flight will be made to Hamilton Inlet on the Labrador Coast; thence southward along the Canadian shore and up the St. Lawrence River to Quebec and Montreal, from which point the flight will proceed south to Washington, D. C., which was its original point of departure. Such an

itinerary will, it is hoped, enable flyers to dodge the rainy seasons in the United States and India and insure their passage through Iceland and Greenland during August and September.

The flight will consist of four officers and four enlisted men well qualified for a long and arduous flight. The selection of this personnel is now under consideration.

The airplanes will be Douglas World-Cruisers, designed and built throughout by the Douglas Airplane Company of Santa Monica, Cal. They have Liberty engines. At Seattle, Wash., they will be equipped with pontoons. Water landings will be made in sheltered harbors along the coast of British Columbia, Alaska, and through the Aleutian Islands, down into Japan. The present plan contemplates the removal of the pontoons and the use of landing gears from Tokio, Japan, or from Calcutta, India, depending upon the conditions which the flight encounters en route. Landing gears will be used across Asia Minor and Europe, as far as Hull, England, where pontoons will again be placed on the airplanes and used until the flight reaches Montreal or Keysport, N. J., at one of which points the pontoons will again be replaced by landing gears for completion of the flight.

The existing airway facilities will be utilized in the United States, southern Japan and between India and London. The intervening sections of the route will be given further study by officers, who will proceed over the route prior to the arrival of the flight.

A path-finding expedition of two officers was sent out sometime ago. Lieutenant Clarence E. Crumrine is at the present time in Greenland, investigating facilities for aviation in that country. Lieutenant Clifford C. Nutt, now in the Philippine Islands, is prepared to visit Japan to make preliminary arrangements when the wishes of that Government are determined. Both of the officers were members of the successful Alaskan Flying Expedition in 1920.

A detailed study of the route is being made in the Office of the Chief of Air Service. The Coast Guard is obtaining data on facilities between Seattle, Wash., and Attu Island in the Aleutian Group, which is the point of departure of the flight from the United States possessions.

Lieutenant Eric H. Nelson, Air Service, has been assigned to duty for the past two months at Santa Monica, Cal., supervising the construction of a special airplane for this flight. Lieutenant Nelson was the engineering officer of the Alaskan flight and, also, on the last year's flight of six Army airplanes from San Antonio, Tex., through the West Indies to Porto Rico and return to Washington, D. C.

In order to assure the availability of every possible facility for the use of this flight, special attention is being given to the weather conditions throughout the route. The proposed airway around the world has been subdivided into six divisions:

First division beginning at Washington, D. C., and ending at Attu Island in the Aleutian Group; second division, ending at Nagasaki, Japan; third division, ending at Calcutta, India; fourth division, ending at Constantinople, Turkey; fifth division, ending at London (Hull), England; sixth division, ending at Washington, D. C. It is proposed to have one advance officer cover each section of this route to obtain detailed information on landing facilities, on land or water transportation, airways, meteorological and climatic conditions and other pertinent subjects. He will make arrangements for the passage of the flight through the territory to which he is assigned. Supplies will have to be shipped from the United States to various points on the route several months in advance.

Previous attempts to encircle the globe by air have been unsuccessful, so the Army Air Service is entering upon the plan with a keen desire to add the accomplishment of an Around-the-World Flight to other records held by aviators of the United States.

WATER BALLAST RECOVERY FOR AIRSHIPS.—By Lieutenant Colonel Ira F. Fravel, Chief of Lighter-than-Air Section, Army Air Service, *Aviation,* 19 November, 1923.—With the completion of the world's largest airships, and the extremely successful trial flights, which have lately been accomplished, much attention is being focused on lighter-than-air craft for air navigation. Coincidently, the use of helium as a lifting gas in place of hydrogen has assumed equal importance because of its reduction of fire hazard. Because of its non-inflammability it is naturally at once the choice for both military and commercial craft. However, the limited supply available and its high cost has in the past been much of a handicap. This has been especially true, because to maintain equilibrium it is necessary at times to "valve," or in other words let some of the gas escape in order to compensate for the weight of fuel consumed, or on account of the expansion of the gas due to the heat of the sun's rays, etc. With another huge airship—the *ZR-3*—nearing completion for the United States, the problem of the preservation of helium gas, if it is to be used in these ships, has become one of vital importance.

In an effort to solve the problem, government engineers have been working along the line of compensating for the weight of the fuel used by recovering some of the moisture in the exhaust gases from the engine and, in addition, attempting to find a method by which the supporting or lifting gas can be maintained at a constant temperature in order to prevent variations in lift due to expansion or contraction.

Attempts to compensate for the weight of the fuel consumed by the recovery of the water vapor component formed as a product of combustion from the exhaust gases from the engines is by no means new. As early as 1915, at least, the British government made some efforts in this direction, as indicated by reports of the British Advisory Committee for Aeronautics in a paper by Guy Barr, which was printed in September of that year. The apparatus, said to be partially successful, was not of sufficient promise at the time to warrant the continuation of tests.

Some time prior to 1920 a type of water recovery apparatus had been developed at the Washington Navy Yard by H. S. McDewell. While the Navy Yard apparatus showed some promise of success, it, like the British attempts, was not sufficiently interesting to the Navy to continue the work. The efforts of Mr. McDewell were, however, of value inasmuch as the information he had gained was very kindly put at the disposal of the Bureau of Standards, when work began there on a similar project for the Army Air Service.

Late in 1920 the Army Air Service requested the Bureau of Standards to attack the problem and, if possible, evolve a practical apparatus for accomplishing the purpose indicated above. The results of this effort are evidenced by the recent successful trial flights of the Army airship *D-3* at Langley Field and the Aberdeen Proving Grounds. Although the experiments were financed and sponsored by the Army Air Service, too great credit cannot be given to Bureau of Standards scientists for developing a really successful device in view of the crude examples which had previously been built and the subsequent abandonment of the project by other agencies. When it is remembered that the work of the Bureau of Standards did not commence until after September, 1920, and that the apparatus was successfully operated and flown for more than fifty-two hours by August of 1922, the rapidity with which this work progressed is apparent.

Some of the details of the design and construction made use of will be of interest. It has long been known that for every pound of fuel economically consumed there is available in the exhaust gases more than 1.4 lb. of water vapor. If this moisture can only be separated, there would

be afforded, therefore, an ample margin to allow for inefficiency in the apparatus and still maintain constant weight. The problem is then one of designing an appropriate water separator which will be light enough to warrant its use. Obviously, a water separator for this purpose must be in the form of a condenser, in some respects similar to that used in steam power plant design.

In the earlier types of condensers built for the purpose of securing water ballast from the exhaust, water was used as a medium for cooling the gases coming from the engine. This water naturally became heated in the process and itself had to be cooled before it could be used again. Radiators for this purpose were necessary and, in addition to their weight, there had to be added the weight of the circulating water. The Bureau of Standards, after a preliminary investigation, decided that if condensers could be built to secure direct cooling of the exhaust gases by air, a distinct advantage would have been gained. In this way a great deal of weight and much extra equipment could be eliminated. After gathering all of the data pertaining to the theoretical and mechanical problems involved in such construction, it was decided to proceed along this line. That such a decision was wise is proven by the fact that the two successful models which have already been built and tested are of the direct air cooled type and weigh about one and one-half pounds per engine horse power, while the best of the water cooled types could probably not be built to weigh less than six or seven pounds per brake horsepower.

The condenser, or water ballast recovering device, consists of a series of long slender pipes or tubes through the inside of which gas is conducted on its way from the exhaust manifolds of the engine to the atmosphere. The air sweeping over the outside of the pipes as the airship is in motion cools the gases and the condensed water vapor is drawn off from the separators through appropriately located drains. The efficiency of the device is sufficient to produce enough water to weigh approximately the same as the fuel consumed.

The condenser itself is made up of aluminum and aluminum alloys. The tubes are about 0.022 inch in wall thickness and one inch outside diameter. In all, approximately 3,000 feet of tubing are used. The actual weight of the apparatus, sufficient to take care of the exhaust from two 150 hp. engines, is around 450 pounds. The preliminary tests made at the Bureau of Standards were made with a standard Liberty engine to furnish both the exhaust gases and the air for cooling. The condenser tubes were set up in the slipstream of the propeller with an inclination toward the rear so that the air would pass to a certain extent laterally across the pipes.

In order to simulate as much as possible actual flying conditions, the unit was suspended from cables in a manner similar to that by which it was later installed on the airship. The "set up" for the experimental test runs, as well as the actual flight test.

As has been mentioned above, successful operation during the test flights of this apparatus has been accomplished some time ago. The next step that will be apparent will probably be the regular installation of similar devices on all service airships. The problem, then, of compensating for the weight of the fuel consumed has been solved, and there remains only that of maintaining the desired temperature of the lifting gas. Work is already in progress along this line and much preliminary data available.

The importance of this work, now that it has been definitely decided to use helium in place of the more dangerous gas, hydrogen, cannot be overestimated. By such methods not only will much valuable gas be saved, but undoubtedly the unit price considerably reduced by the conservation of that already in existence.

MORE MOORING MASTS.—*Aviation*, 19 November, 1923.—The Bureau of Aeronautics proposes to erect airship mooring masts 160 feet high at San Diego, Cal., Fort Worth, Tex., and Guantanamo, Cuba. These masts, which are of the "semi-portable type," are expected to play a large part in the development of airship navigation, provided excellent temporary accommodations for rigid airships in lieu of the expensive hangar construction. The mast at Fort Worth will be adjacent to the U. S. helium production plant there.

ORDNANCE

MUNITIONS OF THE FLEET.—HIGH-EFFICIENCY PROJECTILES: SHELL FIRE AT JUTLAND: WHAT THE EIGHTEEN-INCH GUN CAN DO.—By Hector C. Bywater in *The Naval and Military Record*, 14 November, 1923.—A Press correspondent who witnessed the recent naval display in the Channel has drawn attention to the great increase in fighting efficiency which has taken place since 1914. "Gunnery methods have been revolutionized, the range of accurate shooting practically doubled, and the destructive power of shells, torpedoes, and mines increased beyond calculation. Ship for ship, the Fleet of 1923 is twice as formidable as its predecessor." That is, perhaps, not an over-estimate. In 1914 the decisive range for gunfire was considered to be about 10,000 yards, in spite of the promising results which had attended experimental shoots at 12,000 to 14,000 yards. Under favorable conditions of sea and visibility the present-day Atlantic Fleet would probably score a higher percentage of hits at 20,000 yards than the pre-war fleet obtained at 10,000. Moreover, the effects of its fire would be much more deadly if all one hears about the efficiency of our latest projectiles is true.

It is futile at this time of day to minimize the shortcomings of British naval munitions on the outbreak of war. They have been exposed on the authority of Viscount Jellicoe, and if proof of his assertions were desired it could be found in the ships' gunnery records given in the Jutland Papers. There is no doubt that the fire of the Grand Fleet was very accurate; the German ships both of the battle cruiser force and the main body were hit repeatedly by 12-in., 13.5-in., and 15-in. shell. The *Lützow* appears to have suffered more than any of her consorts, with the *Derfflinger* a good second. While the record of hits on the *Lützow* will never be known with exactitude, owing to the ship having foundered at sea, the *Derfflinger* was struck at least forty times and the *Seydlitz* some thirty times by large caliber projectiles, the last-named vessel also being torpedoed. Yet both these ships kept afloat and returned to port. None of the British ships received anything like the same amount of punishment. For example, the *Lion* had only twelve hits from big shell, the *Princess Royal* nine, the *Tiger* four, and the *New Zealand* one hit. All accounts agree that previous to the fatal salvos neither the *Queen Mary* nor the *Indefatigable* had sustained material damage. Actually, therefore, the total of hits made by the German guns was small. As a rule, however, they were very destructive. The salvos had an extremely small spread, and while this reduced the number of casual hits, it sometimes led to a whole salvo landing bodily on the target, the loss of the *Queen Mary* and *Indefatigable* having been caused in this way.

The Germans appear to have fired only two types of projectile—armor-piercing shell, with a T.N.T. burster, and high-explosive shell, containing a heavy charge of the same compound. Both types were very effective, the armor-piercing projectiles particularly so. In the British Fleet there were three types of shell—A.P., H.E., and Common. A certain proportion of our common shell appear to have been filled with ordinary powder, which gave a poor burst and large fragmentation. Projectiles of this kind cannot

have been very dangerous to the stoutly-armored German ships. The performance of our A.P. shell at Jutland hase been severely criticized by Viscount Jellicoe, but that they did not invariably fail is shown by the number of clean penetrations through thick barbette, turret, and side armor in the *Derfflinger* and *Seydlitz*, to say nothing of other ships. Our lyddite H.E. projectiles seem to have been less effective.

In any case, the net result of the numerous hits our gunners made in the battle was disappointing, and this cannot be ascribed entirely to the robust protection of the German ships. Mr. Churchill has revealed in his second volume of war reminiscences the astonishing fact that when the 15-inch gun first came into service in the *Queen Elizabeth* no high-explosive shell were available for it. The common shell supplied for this gun were filled with powder. In these circumstances one is constrained to wonder why the new caliber was introduced at all. That the quality of the heavy naval shell in stock at the outbreak of war was not altogether satisfactory was no secret to those interested in the subject. For obvious reasons the true position of affairs could not be disclosed; it could only be implied by pointedly emphasizing the close attention which the Germans were known to be paying to the development of their large naval projectiles, and this was done by the present writer, among others. The authorities responsible for this neglect of a vitally important item of naval armament have not been identified. It need only be said that attempts to saddle Parliament and the public with the blame for defective naval equipment are unfair and disingenuous. It is absurd to pretend that Parliament would have refused credits for improving the munitions of the fleet. As a matter of fact, it was never asked to do so.

There was evidently an influential clique in the Navy which attached minor importance to the quality of the projectiles. Their one idea was to mount guns of the largest possible caliber, believing, as they did, that the mere impact of 13.5- and 15-inch shell would shatter any battleship afloat. They also exaggerated the effect of superficial burst on heavily-plated ships. Obsessed with the picture of frightful destruction wrought by the Japanese lyddite *portmanteaux* at Tsushima, they overlooked the considerable difference between the small, armor-patched, and inflammable ships of the Russian fleet of 1904 and the strongly-built and stoutly-plated Dreadnaughts of the German Navy of 1914. And, as we now know, even the possibilities of high-explosive attack were not fully exploited. T.N.T. was apparently not adopted as a shell filling until the war was well advanced, though its superior properties were recognized long beforehand.

It is satisfactory to learn, on good authority, that all the munitions now used in the British Navy are of the highest efficiency. In this country the development of ships' artillery reached its peak in the 18-inch gun, a caliber now banned by the Washington Treaty. Sir Robert Hadfield, in his address to the Birmingham Metallurgical Society on October 30, gave some remarkable data in illustration of the power of this tremendous weapon. The 18-inch gun, he stated, weighs about 150 tons, and when elevated to forty-five degrees is able to hurl its loaded capped projectile of 3,320 pounds a distance of some 50,000 yards. When capped and striking normally the projectile will pass unbroken through thick armour. At point-blank range it will pierce forty-one inches of hard-faced armor, equivalent to a 4½-foot wall of unhardened steel. "At ten and twenty miles respectively, twenty-two inches and twelve and one-half inches of hard-faced armor of the latest and best type are perforated. Finally, at the extreme range of no less than thirty miles, the projectile passes intact through nearly one foot of ordinary steel armor. In actual trials the projectiles from this gun perforated hard-faced plates of a thickness nearly equal to the caliber of the gun, and this at an angle of twenty degrees, at a velocity equivalent to a range of about nine miles. Thus the heaviest

armor afloat, when attacked by an 18-inch gun, would not appear to be, metaphorically speaking, much better than cardboard."

Impressive as are the details of this monster cannon, there is every reason to suppose that our 15-inch and 13.5-inch guns would have been quite large enough for all war-time requirements had they been supplied with projectiles of maximum efficiency. Jutland, from the strategical point of view, was a decisive victory. Most probably it would have been an overwhelming tactical victory had the ammunition of the Grand Fleet been of first-class quality.

CRUISER ARMAMENT.—*The Naval and Military Record*, 7 November, 1923.—When the battleships *Anson* and *Rodney* were projected it was decided to arm them with 16-inch guns, although this was a caliber new to our Navy, and its manufacture entailed more expense than that of the 15-inch model. Nevertheless, the heavier gun was selected in order that our latest battleships should be fully equal in hitting power to their foreign "opposite numbers." If the same principle governs the design of our new cruisers, they will mount an armament of 8-inch guns, for batteries of this caliber have already been adopted for the latest Japanese ships.

Naval opinion, as is well known, would prefer to keep to the 6-inch Q.F., which in our service has always been regarded as the ideal cruiser gun, owing to its handiness, rapid fire, and high ballistical qualities. But, as the Coronel action proved beyond dispute, ships armed with this gun cannot fight on equal terms against an adversary who carries heavier metal. Given a common standard of marksmanship, weight of fire is bound to be decisive in the end. We have in the 7.5-inch a gun of extraordinary power for its size, but its shell weighs from sixty to seventy pounds less than the foreign 8-inch projectile. Consequently, if our new cruisers are to be second to none in fighting power, they should be armed with 8-inch guns. This, like the 16-inch, would be a new model in our service. Its last appearance was in the four protected cruisers of the *River* class, built in the late eighties. These ships, the *Thames, Mersey, Severn,* and *Forth*, each mounted two 8-inch pieces as bow and stern chasers, besides ten 6-inch on the broadside, and were, in fact, overweighted with armament.

The old 8-inch gun weighed 15 tons, its 210-lb. projectile having a penetration at the muzzle of nineteen inches of wrought iron, or twelve and nine-tenths inches, at a range of 2,000 yards. It was, therefore, a very powerful weapon for those days. Sir George Thurston, than whom there is no higher authority, foresees no technical difficulty in building a 10,000-ton cruiser with 34 knots speed and eight 8-inch guns. Our new cruisers must in any case be made equal to the very best ships building or projected abroad.

ANTI-AIRCRAFT GUNS.—*Army and Navy Journal*, 24 November, 1923.—There are four types of anti-aircraft guns now in process of development. The first of the new guns is the 50-caliber machine gun with a horizontal range of about 27,000 feet, a straight-up range of 9,000 to 12,000 feet and a rate of fire of about 500 shots a minute. Fire control is to be maintained with this gun through new tracer ammunition, visible by night up to 7,500 feet and by day up to 6,000 feet. The 50-caliber gun is under manufacture for issue as substitute for the 30-caliber weapon, now used, which latter is a relic of war days.

The second gun under development is a 37-mm. machine gun, firing high explosive shells with fuses so delicately adjusted that the shells, while safe to handle before firing, explode on contact with balloon fabric once they have been discharged from the gun. A rate of fire of 100 to 120 shots a minute is expected with this weapon, as is also a straight up range of about 14,000 feet and tracer ammunition visible up to 10,000 feet,

making possible accurate firing up to that point. It is planned to install these weapons in batteries of four operating with a single telescopic sight control and to be trained and fired by a single gunner.

The third new gun in the group is a 3-inch weapon on a mobile mount with a rate of fire of fifteen shots a minute, effective at altitudes up to 21,000 feet, and with full 360 degree traverse to enable the gunner to follow his target in any direction. It can be fired at an elevation of eighty degrees and has a horizontal range of more than 38,000 feet with projectiles weighing fifteen pounds and containing a heavy bursting charge. Guns and mounts of this type are now under test at Army proving grounds.

Gun No. 4 in the anti-aircraft list is the 4.7-inch, firing a 45-pound shell to an effective altitude of about 30,000 feet. It is to be mounted on a mobile carriage with full traverse and equipped for power loading and with an automatic breech block to speed up firing. This gun also can be fired at an elevation of eighty degrees or within ten degrees of straight over the gunner's head.

As a supplement to these new weapons, the experts are working out a system of indirect aiming, experiments having shown that central control firing is greatly superior to the old wartime systems. Two types of central stations are under development, either of which will obviate the necessity for altimeter stations and baseline readings materially speed up aiming and firing, although requiring less personnel in operation than the old control method.

FATE OF THE BIG BERTHAS.—*The Literary Digest*, 24 November, 1923.—There were no less than seven "Big Berthas," but none now remains, we are told by the Frankfort *General Anzeiger*. *Le Matin* (Paris) quotes the following passages, with reservations, as a purely German version of the facts. We read:

"The long-range guns that bombarded Paris in 1918 were built in the Krupp works. Seven guns of this type were made, in all. When the German Army began its movement of retreat in the summer of 1918, three of these pieces were in service at the front, while the others were still in the Krupp factory. As there was no more chance of bombarding Paris, two of them were completely taken apart; some of the parts served to build other cannon, while the rest was melted up. Two other guns had been so used up that they could be no longer employed for long-range work and were finally broken up at the works. On the signature of the Armistice there were in existence only three long-range guns, which had been placed since the beginning of the German retreat. It is therefore not at all strange that, despite the precipitate retreat of the Germans, the cannon in question were not discovered. Foreseeing the occupation of the Ruhr, these three guns were completely destroyed in the course of the year 1919; their remains were broken up or used for building industrial or other machinery. All the statements made in divers places, according to which four long-range cannon still exist in one form or another, are absolutely without foundation."

NAVIGATION AND RADIO

FLIGHT TO POLE TO BE ESSAYED BY NAVY CRAFT.—Washington, December 3.—A dash by air for the North Pole will be launched by the Navy Department next summer. Secretary Denby announced today that President Coolidge had given his specific approval to the project as "of great practical value."

The route, date and method of procedure for the trip, however, are still to be decided, a special board of naval officers headed by Rear-Admiral William A. Moffett, chief of naval aeronautics, having been appointed by Secretary Denby to prepare a detailed plan.

The project grew out of the desire of Robert A. Bartlett, the explorer who sailed with Rear-Admiral Robert E. Peary in the steamer *Roosevelt*, on the expedition of 1908-9, which saw the Stars and Stripes raised over the North Pole, again to make that journey. Mr. Bartlett proposed to Secretary Denby some months ago that the *Roosevelt*, now in commercial service, be repurchased and equipped for polar work.

Discussion of the possibilities of a new polar expedition was immediately begun in the Navy Department. It was pointed out by naval aircraft experts, however, that if a new "drifting" expedition was organized by the Navy, others, perhaps under another flag, might attempt and complete a journey to the pole by air before the *Roosevelt* party could make half the distance. The decision to employ naval aircraft followed.

Mr. Bartlett, who is a lieutenant-commander in the Naval Reserve force, for the purposes of the polar expedition already has been called to active service in that rank and appointed to the special planning board, of which he will also be recorder. Other members of the board are Commander William R. Furlong, Lieutenant-Commander Ezra G. Allen and Lieutenant-Commander Fitzhugh Green and Gilbert Grosvenor, president of the National Geographic Society.

Admiral Moffett's board has at its disposal all the Government's records of previous Arctic explorations, as well as all information that the American Geographic Society is able to furnish. On the study of this data as well as records of weather conditions in the Arctic will be found a recommendation as to whether the last lap of the journey shall be undertaken in airplanes equipped with skis for landing on the ice, or with the great Navy dirigible *Shenandoah*.

Naval officers feel that the *Shenandoah* in many ways would be the most desirable ship for the dash, particularly because the airship can hover over the Arctic regions while motion-picture records are made or scientific data otherwise obtained. There is no disposition, however, to risk the *Shenandoah* unless there is every reasonable prospect that she can successfully accomplish the mission.

The announcement by the Navy Department as to the instructions given to Admiral Moffett's board said that the purpose of the study would be "to devise plans for an extensive exploration over unknown regions adjacent to the pole."

"When the expedition shall sail," the announcement continued, "of what it shall consist and what its plans will be are not at present known. These topics, among many others, will be the subject of investigation by the board."

The precept of the board under which it was created merely directs it to prepare a detailed plan and to "convene the board as soon as practicable."

In writing Secretary Denby, under date of November 20, approving the project, President Coolidge expressed the belief that it would be "carried through with the thoroughness and efficiency which marks every project which the navy undertakes."

The President's letter follows:

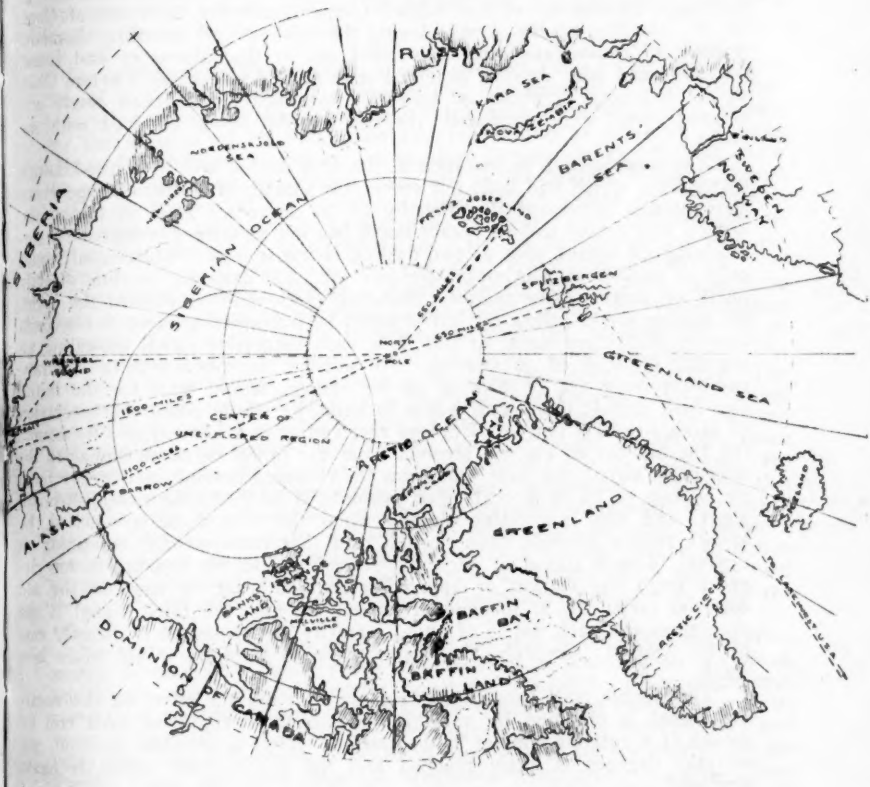
"I desire to confirm by this letter," President Coolidge said, "the verbal authorization which I have already given you to proceed with the organization of a naval Arctic expedition which will start in the coming year. The record of the Army and Navy in this line of endeavor is one of which the American people will always be proud, for it is marked by a spirit of heroism and devotion which is unexcelled in the history of exploration.

"As it fell to the Navy to achieve the final goal through the efforts of Admiral Peary it is eminently fitting that the Navy should continue the work, and I believe that the expedition which you have in view will be of

great practical value and will be carried through with that thoroughness and efficiency which mark every project which the Navy undertakes."

AMUNDSEN EXPEDITION TO CARRY OUT PLANS.—*Baltimore Sun*, 4 December, 1923.—New York, December 3.—The Navy Department's decision to launch a dash by air for the North Pole during the coming summer will result in a friendly competition between the Navy and the Amundsen air expedition, which will about the same time make its second attempt to fly over the pole, Hakon H. Hammer, Captain Amundsen's aide, said tonight.

Mr. Hammer said that, in view of the fact that the Navy has assigned



Lieutenant Ralph Davison to pilot a third plane in the Amundsen-Hammer expedition, he took it for granted that the two trans-Polar expeditions would engage in a "very friendly competition."

"The Navy's announcement will in no way change our plans," he said. "On the contrary, it amounts to an indorsement of our undertaking and greatly increases the inspiration."

RADIO-BEACONS FOR AIRPLANES.—*Literary Digest*, 24 November, 1923.—Cross-country flights will in future be guided from field to field by direction signals given out from fixt radio stations. The flyer who receives

these will know at once his exact location with reference to the next station, and will govern himself accordingly. The necessity that all apparatus should be in a fixt location on the ground has made it necessary to devise an entirely different signal system from that in use in ocean-navigation. This new radio navigational development for aiding flyers along the Army model airways is not yet ready for use, we are told by *The Radio World* (New York), but work on the first radio beacon at Wilbur Wright Field at Fairfield, Ohio, will be undertaken shortly by the Army. Says this paper:

"The new aerial radio beacon is the result of experiments conducted at the radio laboratory of the Signal Corps under the direction of Capt. W. H. Murphy, of the Army, during the past several months. A model directional radio-transmitter was tried out at the laboratory and found operative and later used in practical tests at McCook Field, Dayton, Ohio, up to distances of about 40 miles. Experiments with both single and crossed loops were employed, the best results being obtained with the latter.

"The apparatus to be installed at the first station will be a five-kilowatt transmitter which will send out successive signals of a distinct type every five seconds, separated directionally by 30 degrees. That is, taking the station as a center and the exact north bearing as 0 or 360 degrees, a significant code signal, such as two dashes, is transmitted. This signal would only be audible at maximum strength for each dash on the line directly north or south of the station. Rotating clock-wise or toward the right; the station would follow the initial signal by transmitting every five seconds another distinctive signal of two dots, each successive signal indicating an angular distance of 30 degrees. An aviator, equipped with a standard radio-receiving set, on picking up the station, would wait for the initial two-dash signal; then, with watch in hand, he would count the succession of signals until a pair of dots was received at equal intensity. By counting the number of elapsed seconds from the initial or north signal to the maximum signal, the flyer will know his compass-bearing in degrees from the beacon, or its reciprocal. For example, if he hears the two-dash north signal and four successive signals when the maximum is reached, he knows twenty seconds have elapsed, and that consequently, reckoning 30 degrees to each signal or each five-second period, his bearing is 120 degrees from the station or approximately southeast by east on the old compass card. If, at the end of fifteen seconds, the third signal is the maximum and each dot is of equal intensity, he knows he is directly east of the station; similarly, the sixth, after 30 seconds, would place him south.

"The double coils used in sending are fixt, but the effect of the rotating signal is obtained by varying the current strength in each coil by means of a rotating coupler in the station. After a complete rotation, 360 or zero degrees is again reached and the double-dash signal is again emitted."

With the new station in operation, we are assured air service and signal corps experts expect that pilots within a range of approximately 200 miles can be served with a directional signal. When each air field is so equipped, it will be possible for flyers to travel from field to field in bad fog or at night with increased safety. To quote further:

"Fixt ground beacons of this type are favored against the development of special direction-finding equipment on aircraft, in order to keep all special equipment on the ground, and use only standard radio equipment for communication and navigation on aircraft, saving space and weight. The system is different from lighthouse radio beacons in that succeeding equal-strength signals rotate at the rate of one revolution per minute, whereas the lighthouse sends them in all directions at once.

"The only drawback is that the direction or its reciprocal may be used, but as the pilot is usually approaching, there is little likelihood of his being north and thinking he is south or vice versa.

"One useful adaptation for this radio beacon signal is its use by naval airplane carriers or battle-ships carrying airplanes for calling and 'guiding home' their seaplanes after long reconnaissances or when lost in fog or darkness. Planes often operate far out of sight of their mother ships, and their compasses sometimes get out of order, in which event a guiding radio call on the rotating principle from their ship would be of great aid, especially when a plane was low in gas and not in a position to conduct a long search for its floating base."

GIANT NEBRASKA RELAY WILL SPEED CONCERTS FROM COAST TO COAST.—Special to the *Transcript:* Hastings, Neb., November 21.—This place has been selected by the Westinghouse Electric and Manufacturing Company for the location of its first radio relaying station to serve as the connecting link of the pioneer station at East Pittsburgh, Pa., KDKA, with the people living on the Pacific coast and in the Middle Western States.

The installation of the Hastings station KFKX means that broadcasts from Station KDKA will be picked up as easily and with the same apparatus in the farthest Western States as KDKA's broadcasts are now received by people living a few hundred miles from East Pittsburgh.

The relaying station marks a great forward step in radio, almost as great a stride in radio progress as was made when the Westinghouse Company first started radio broadcasting with the establishment of its world pioneer broadcaster, Station KDKA, in November, 1920. It has removed the limitations of distance in the broadcasting of programs. The transmitting station at KDKA is as fine and as modern as radio engineers can make it. It is possible to receive the KDKA all over the country, but, naturally, the greater the distance away from the station, the more sensitive must be the apparatus. To pick up KDKA in California, for instance, requires very sensitive, high-priced apparatus. Knowing this condition, the Westinghouse Company by experimenting with short-wave relaying stations has made it possible to rebroadcast or relay its Eastern concerts from Hastings, which will serve as a booster station to points on the Pacific coast. Thus the same simple apparatus which can be used on the Pacific coast to pick up local broadcasters can also pick up the relayed KDKA.

The station at Hastings is one of the marvels of the radio engineering world, for not only can it relay from KDKA in the East on one wave, but it can also transmit concerts direct from KDKA; or transmit concerts from its own locality. KFKK, for example, can receive broadcasts from KDKA on, say 3,200 kilocycle frequency (ninety-four meters) and relay the same broadcasts to another transmitting station located on the Pacific Coast on 2,800 kilocycle frequency (107 meters). Both these frequencies are much higher than are used in radio broadcasting and will not interfere either with radio broadcast traffic or amateur traffic. The next step in this plan would be to tie up with a Western station to pick up the 2,800 kilocycle frequency (107 meters) broadcasts and rebroadcast on the regulation broadcast wavelengths or frequencies.

KFKX can receive, also, broadcasts sent from KDKA on 3,200 kilocycle frequency (ninety-four meters) and transmit direct to its territory on 1,050 kilocycles frequency (286 meters) which is its assigned broadcasting wavelength. It can transmit also its own broadcasts from a local source on 1,050 kilocycles, for the benefit of the people living in its territory or westward to the Pacific Ocean.

For this relaying—short wave relaying as it is termed in the radio engineering world—two special transmitters are required, with special

receivers to receive the high frequencies. Hastings, Neb., and East Pittsburgh, Pa., have duplicate transmitters and receivers. The Hastings station is one of the finest in the world as is also the station at East Pittsburgh. A feature of the high frequency broadcasters is the short antenna used. The antennæ at Hastings and at East Pittsburgh are not over thirty-five feet long. This is much smaller than the antennæ required for ordinary broadcasting. There is only thirty-five feet between flat top and counterpoise. The antenna and counterpoise consist of two small cages.

One of the difficulties attendant upon high frequency broadcasting is that every precaution must be taken to prevent any outside influences, such as vibration, that would change the frequency. The vibration of the ground or the swinging of the antenna would serve to throw the set off its frequency. To guard against the possibility of swinging, both the East Pittsburgh and Hastings high frequency stations' antennæ, including the flat top and counterpoise, are stretched between crossarms rigidly attached to the tower instead of the more common swinging spreaders.

The down lead from the antenna to the counterpoise consists of copper tubing rigidly mounted on long high voltage porcelain insulators on the poles. The various inductances on the set are wound on rigid forms. Copper tubing is used to make all the connections. The high frequency set at East Pittsburgh is located on the top of a nine-story building and naturally would ordinarily be subjected to jars. This set is therefore suspended on a system of springs and vibrations of the building cannot affect the operation of the set. At Hastings the set is located in an isolated building and is not subjected to any vibrations, so the precaution of suspending this set on springs has not been necessary.

The transmitting set at Hastings consists of three panels, as follows, the rectifier panel, the modulator panel and the oscillator panel. The rectifier converts the high voltage A. C. current received on the antenna to high voltage D. C. for the plate circuit. The modulator with its accessories impresses the voice frequency on this high voltage D. C. current before it goes to the oscillator. Finally the oscillator converts the high voltage D. C. currents into radio frequency, in which form it is delivered to the antenna. For local broadcasting a studio has been suggested in the main business section of Hastings, which will be connected with the station by means of telephone lines. The studio, if built, will compare favorably with any Eastern studio, and a special type of condenser transmitter will be installed to insure good tonal quality.

Because of the establishment of this station, Hastings, the little town in the Middle West, has a radio station that compares favorably with any transmitters now in operation. In power, pick-up tone and other radio qualities it ranks in efficiency with KDKA, acknowledged to be one of the finest broadcasters in the world.

Station KFKX, whatever may be its fate, will always live in radio history as the first relaying and rebroadcasting station in the world to be established for practical daily broadcasts.

MISCELLANEOUS

ASSOCIATED AMERICAN CHAMBERS IN CHINA HOLD SUCCESSFUL MEETING.—*China Weekly Review*, 20 October, 1923.—The development of a definite American policy toward China, an increase of the American military and naval forces in China up to their full treaty status, opposition to relinquishment of extraterritoriality at the present time, and a number of other important matters affecting the relations of China and the United States were the subjects of resolutions adopted at the second annual conference of American Chambers of Commerce of China which closed its session on Wednesday, October 17, after

two busy days of work. This year for the first time, the American Chamber of Commerce in Manila was represented by a delegate, A. G. Henerson. The other delegates were: Myron Simon, Tientsin; F. J. Deane, Peking; R. A. Frost, Hankow and the following representing the Shanghai chamber; J. Harold Dollar, H. A. Wiley, H. B. Lane, N. H. Kennedy, F. F. Fairman and J. B. Powell.

The subjects considered included, illegal taxation contrary to treaty provisions, disorder in China, purchase of consular property by the United States government, American policy toward China, extraterritoriality, the special tariff conference authorized by the Washington Conference, exchange of news between China and the United States, improvement in the Yangtsze patrol, opposition to frequent changes in American officialdom in China, China's default upon American loans, obligations for materials purchased by the Chinese government, claims against the government for property destroyed by bandits and uncontrolled soldiery, improvements in the status of the U. S. Court for China, endorsement of the Rogers Bill now in Congress which is intended to improve the status of the U. S. consular and diplomatic services, approval of the action of the State Department in ruling that obligations of American citizens against the Chinese government railways for materials sold, to the effect that these obligations have priority in payment over interest payments on the bonded indebtedness. It is the intention of the Associated Chambers to publish the results of the meeting in pamphlet form for general distribution in the United States.

On the subject of American policy toward China, it was decided to recommend to Washington that in the continued failure of France to ratify the Washington Conference treaties, that the United States take up at once with the interested powers willing to co-operate in the matter of a definite policy toward China on account of the present serious internal situation. On the subject of disorder in China, a very strong resolution condemning the present condition of military-anarchy was passed which recommended that the proper protection of American lives and property necessitated an immediate strengthening of the U. S. military and naval forces in this part of the world to their full treaty strength. This includes the bringing of the American regiment stationed in Tientsin under the Boxer protocol of 1901 up to its full strength, an increase in the marine guard at Peking and the addition of six new patrol boats to the Yangtsze squadron. On the subject of extraterritoriality it was decided that no action should be taken toward consideration of relinquishments on the part of the United States in view of the present disturbed situation of China.

On the subject of the U. S. Court for China a measure now in the hands of the legal committee of the Shanghai Chamber received the approval of the Association and as soon as drafted in proper form will be sent to Washington for introduction in the coming session of Congress. The measure provides for the transfer of the U. S. Court for China from the nominal jurisdiction of the State Department to the jurisdiction of the Department of Justice. It also provides for raising the status of the present court commissioner to that of an assistant judge and also the creation of a modified form of jury trial considered to be workable in China. Another measure of special interest to American residents of the Far East was approval given a measure submitted by the Manila Chamber which includes a strong recommendation of Governor-General Wood that the U. S. government forego collection of income taxes upon American citizens residing abroad who derive their incomes abroad.

The annual conference closed with a dinner at the Palace Hotel on Wednesday evening, October 17 which was attended by members of the

Shanghai chamber, visiting delegates and leaders of the American missionary bodies.

FOREIGN NAVAL NOTES.—By Hector C. Bywater, *The Naval and Military Record*, 28 November, 1923.—Balance of Power in Mediterranean: The Italo-Spanish Entente: Seaplanes for Submarines.—French naval authorities do not appear to be greatly perturbed by the current talk in Rome and Madrid of an Italo-Spanish maritime entente. On the occasion of the recent Spanish Royal visit to the Italian Court the best warships of the two nations met at sea, a circumstance which has led their newspapers to indulge in some rather fantastic speculations on the strategic possibilities of the future. The Madrid journal *El Sol*, quoted by *The Times* correspondent, pointed out some months since that the Italian and Spanish naval programs both provide for defensive fleets of light cruisers, torpedo vessels, submarines, and aircraft, adding that "the united sea power of both countries, utilizing the Balearic Islands as a base, could draw an unbreakable line across the Western Mediterranean—that is, right across the French main line of communications with Africa, which becomes ever more important." Considering the great distance between the coasts of Italy and Spain, it is not easy to see how such an "unbreakable line" could be established, even with the naval resources jointly at their disposal. Its eastern flank would be endangered by French flotillas and aircraft operating from Bizerta, while in the west the line of blockade would be exposed to attack by French forces striking from Toulon in the north and the Algerian ports in the south. It would, indeed, be far less difficult for the French Navy to interpose an impassable barrier to communications between Spain and Italy.

When the Italian papers write gradiosely of the present Spanish Navy as "a force already powerful enough to sway the balance of power in the Mediterranean," they are doing some violence to the facts. In spite of a relatively enormous outlay of money during the past ten years, Spain does not yet possess a fleet capable of playing a serious part in grand strategy, either in the Mediterranean or elsewhere. Now that the *España* has been wrecked, she has only two battleships left, and even these are of a type which is obsolete. Notwithstanding their armament of high-power 12-inch guns, the *Alfonso XIII.* and the *Jaime I.* are so inadequately protected that they could not engage the French 12-inch-gun ships (*Jean Bart* class) with any prospect of success. Apart from these two ships, Spain has only three modern cruisers completed, less than a dozen effective destroyers, about a score of small torpedo-boats, only serviceable in coastal waters, and ten submarines. As for aircraft, the number of naval machines actually in hand at this date is very small, and their efficiency is problematical. There is no realiable information concerning the state of the personnel, but last year the establishment was below its authorized strength, and was said to include a large proportion of imperfectly-trained men.

A survey of Italian naval policy, material, and personnel was given in this column so recently that the subject does not call for further elaboration. The strength of the Italian Navy resides chiefly in its light flotillas, which have been developed with remarkable vigor and consistency during and since the war. The five battleships are outclassed by the six corresponding units under the French flag in every quality save speed. In light cruisers the French Navy will have gained a big lead when its three new ships of the *Duguay-Trouin* class are commissioned. It is also much the strongest in all varieties of that *poussère navale* which might prove of inestimable value in a Mediterranean campaign. Italy, on the other hand, has a slight advantage in the numbers and modernity of her de-

stroyers, but this will disappear when the current French program matures. In submarines France is distinctly ahead, not only in numbers, but in quality, and still more so in respect of naval aviation, her aircraft outnumbering those of Italy by at least two to one. A combination of the Italian and Spanish forces, even if it were physically practicable, would still leave the French Fleet superior in material, while its strategic position would be highly advantageous for dealing with such a hostile coalition. There is, in fact, no real foundation for the hopes of an Italo-Spanish hegemony in the Mediterranean expressed by *El Sol* and other Spanish journals, and echoed by the Fascist Press of Italy.

The United States submarine *S 1* has been detailed for experiments which are now in progress at Hampton Roads to test the feasibility of equipping submarines with a small scouting seaplane. The machine under trial, *M S 1*, was built by the Glenn-Martin Company, of Cleveland, Ohio. It has an all-metal body, and is of such minute dimensions that, with wings folded, it can be stowed away in a small compartment immediately below the deck of the submarine. This compartment is apparently not watertight, but the action of the sea water will not, it is claimed, in any way impair the efficiency of the plane. When required for service it can be brought up and made ready for flight in a few minutes. Intended solely for scouting purposes, it will carry no armament except, perhaps, a light machine gun, but wireless apparatus is fitted. After being hoisted over the side it will take off from the water, and, on completing its flight, descend on the surface near the submarine, which will then pick it up and stow it below again. If these experiments are successful similar machines will in future be carried by all the larger United States submarines, such as the *S*, *T*, and *V* boats; but some considerable time must elapse before all these boats are so equipped, as it is necessary to make structural alterations in each case. The value of a seaplane auxiliary to any submarine engaged either in reconnaissance, patrol, or commerce-destroying work is obvious. It would eliminate what is at present one of the submarine's greatest drawbacks: viz., restricted vision.

It is now officially confirmed from Tokio that the economies to be effected in the Japanese naval budget will have no reaction on the program of new construction, beyond extending the date of maturity by twelve months. The light cruisers, destroyers, submarines, and auxiliary vessels now building or on order will therefore be completel by 1927, instead of 1926. A proposal by certain members of the Cabinet that the building scheme should be reduced by 10,000 to 15,000 tons, the money thus saved being diverted to the fund for national reconstruction, was decisively rejected by the naval authorities, who were supported by the Premier. All indications point to great activity in the Japanese Dockyards during the next four years, the volume of work to be completed within that period being very large. Vessels already on the stocks or completing afloat comprise the following: Eight cruisers, two aircraft-carriers (*Kaga*, ex-battleship, and *Akagi*, ex-battle-cruiser), eleven destroyers, eighteen submarines, four gunboats, and five fleet auxiliaries. In addition there remain to be laid down and completed before the end of 1927 six cruisers (two of 7,200 tons, four of 10,000 tons), twelve destroyers, sixteen submarines, and about six auxiliaries. As it is improbable that any new construction can be undertaken at Yokosuka in the near future, owing to the devastation caused by the earthquake, the 10,000-ton cruiser allotted to that yard some months ago will, it is expected, be built at Sasebo. Material for a second ship of this class, assigned to Kure Dockyard, was being assembled in August, so that work on the vessel may have been started by now. The third and fourth cruisers of the 10,000-ton class are likely to go to private builders, the Kawasaki and Mitsubishi firms being mentioned in this connection.

Side by side with the expansion of cruisers and other light craft, the work of modernizing the battle fleet is to proceed systematically. The four ships of the *Fuso-Ise* class will have their protection against underwater and aerial attack improved by the fitting of bulges and additional armor over magazines, etc. It is proposed to substitute a new 10-cm. anti-aircraft gun for the 3-inch piece which is at present mounted for high angle fire in all the larger Japanese ships. The torpedo nets, which the Japanese Navy alone retains, are soon to be abolished, recent experiments having shown that even the specially strong nets with which the battleships are fitted offer no real defense against torpedoes of the latest type.

THE BRITISH EMPIRE.—"Armies and Navies of the World" by Graser Schornstheimer, in *Monthly History of World Events*, December, 1923.—In England the controversy between the champions of the battleship and the airplane continues to rage bitterly. The press points out that the aircraft enthusiasts are confined in the Navy to retired officers who have not seen service in many years—men of the type of Admiral Sir Percy Scott and Rear Admiral Mark Kerr. On the other hand, the defenders of the battleship type number practically the whole of the active British Navy and Naval Air Division of the Royal Air Force. Those opposing Sir Percy include Admirals Jellicoe, Beatty, Sturdee, de Roebuck, Madden, Cowan, Field, Phillimore, Sinclair and other fleet commanders.

In a debate with Admiral Sir Percy Scott, Admiral of the fleet, Sir Doveton Sturdee, victor over Von Spee in the Falkland Islands battle, forced Sir Percy to admit that, despite his statements reproving the Admiralty for building battleships and for building the base at Singapore, he would, if First Lord of the Admiralty, continue to build battleships. Admiral Scott was again taken to task by Admiral Sir R. F. Phillimore, Commander-in-Chief at Plymouth, who in a speech said: "I see Sir Percy Scott continues to put the question and bother his head about what is the use of battleships. I think the answer is a very simple one. The battleship is required to fight other battleships. When other countries cease to build battleships then, and not before then, shall we be able to stop building battleships."

The aircraft carrier *Hermes*, the first ship ever built from the keel up to carry aircraft, has been completed in England. The ship displaces 11,000 tons and has a speed of twenty-five knots. It carries twenty airplanes and has a battery of ten 6-inch and four 4-inch anti-aircraft guns.

In response to the request of British merchants the Admiralty has decided to send the first light cruiser squadron on a cruise around the world. The merchants wished to have the battle cruisers, with the great *Hood* as flagship, for the cruise, but the Admiralty declined to detach three of the most important vessels of the fleet from home waters because of the existing situation. The squadron consists of the cruisers *Delhi*, flagship of Rear Admiral Hubert G. Brand; the *Dauntless*, which visited American waters a few years ago bearing the bodies of the victims of the *ZR-2* disaster; the *Dunedin*, *Danae* and *Dragon*. They are 4,750-ton ships, having a speed of thirty knots and carrying six 6-inch guns.

ITALY

It is still a matter of dispute whether or not the battleship *Leonardo da Vinci*, sunk during the war, is to be repaired and placed in the line. It is pointed out that the Italian Navy has but five line-of-battle ships, and that the *da Vinci* is included in Italy's tonnage quota established at the Washington Conference.

The new program of two 10,000-ton cruisers, six large destroyers and

six submarines is about to be taken in hand. The vessels are considered as an answer to the French program drawn on the same lines.

Spain

It is now proposed to scrap the battleship *España*, recently wrecked off the coast of Morocco, near Melilla. This ship, while one of the largest in the Spanish Navy, is entirely overshadowed by every modern battleship possessed by other powers. In official quarters it is rumored that the new Government will greatly curtail the present naval program in an effort to concentrate all the available funds in military appropriations. This is to the end of retrieving the disasters of the Riff campaigns.

Argentina

A large naval commission is being dispatched to the United States in connection with the coming refitting of the largest ships in the Navy, the *Moreno* and *Rivadavia*, in American yards. It is also proposed to build twelve large destroyers, but the details of this program are not available at present. Supplies and munitions of various kinds are now being purchased for the Army. They are the first to be obtained in more than ten years.

Brazil

The Brazilian training squadron has just completed a tactical training cruise under the direction of the members of the American Naval Commission. The ships were divided into two squadrons, with a battleship as flagship of each. The results have been gratifying to the Brazilian Navy Department, and have served to bring attention to the engineering branch of the naval service, which has been neglected for some time. No attempt is to be made at present to build new ships. All the available money of the Navy Department is being used to refit and extend the various navy yards, principally the Cobras Island base, near Rio de Janeiro.

Effect of Rotation of Earth on Weight of Ships.—*The Nautical Gazette*, 8 December, 1923.—A few weeks ago what was described as "a remarkable navigation announcement" was issued at Washington to the effect that a ship traveling eastward is lighter than when going westward as a result of the earth's rotation. Why this is so was recently explained in *The Engineer*, which points out that there is nothing novel in this so-called discovery. Since a vessel traveling at 25 knots has a speed of forty-two feet per second and since the peripheral speed of the earth at the equator is 1,560 feet, it is clear that when steaming westward, with the two speeds opposing each other, the true lineal velocity of the ship is 1,518 feet per second, while on an eastward course it is 1,602 feet. The surface speed of the earth diminishes according to the degree of latitude being, for example, only 1,213 feet per second in latitude thirty-nine degrees, which is the latitude of Baltimore.

At the equator the centrifugal force on a 1,100-ton destroyer, traveling at 25 knots, is 8,410 pounds on a westward and 9,366 pounds on an eastward course, indicating a difference of 959 pounds between the two conditions.

Note: These facts were first published in the Proceedings of the Naval Institute in August, 1921 by Alan S. Hans Resworth F. R. S. A.

CURRENT NAVAL AND PROFESSIONAL PAPERS AND ARTICLES

"The Importance of Battleships, Cruisers and Suitably Placed Bases for Maintaining the Overseas Communications."—By Admiral of the Fleet Sir F. C. D. Sturdee, Bart., G.C.B., K.C.M.G., C.V.O., *Journal of the Royal United Service Institution,* November, 1923.

"Metals in Engineering Service—A Few Notes on Design, Choice of Materials and Inspection of Failures."—By Gordon Sproule, M.Sc., A.M.E.I.C., *The Engineering Journal,* December, 1923.

"The Emmet Mercury Boiler."—*Power,* 4 December, 1923.

"Ship Form and Steering."—A. W. Johns, C.B.E., R.C.N.C., M.I.N.A., *The Engineer,* 23 November (No. 1), and 30 November, 1923 (No. 2).

"The German Long-Range Gun," Part II.—By H. W. Miller, *Army Ordnance,* November-December, 1923.

"Electric Arc Welding."—By M. F. Wilson, A.M.E.I.C., *The Engineering Journal* (Engineering Institute of Canada).

The conclusion of this article is as follows:

"In this rapid survey of the electric arc weld many important parts have been omitted, such as the design of glasses and face shields, methods of allowing for expansion and contraction, many other practical applications than those shown, method of inspecting and testing welds, and costs. Only the three prime factors for successful welding, equipment, material, skill, have been briefly dealt with. As regards the equipment it has been shown that it is essential to have a machine which responds quickly to the rapid changes in the resistance of the arc, and that A.C. equipment is as successful as D.C. As regards material there must be relationship between the electrode and the work; that as the electric arc process is essentially a casting, whatever material is used must be treated to respond to the characteristics of the material. For example, if it is a high percentage manganese steel that is used, it must be given the same treatment that a manganese casting would go through (rapid cooling, etc.), and it must be protected from the action of the atmosphere by coatings which will not allow its physical characteristics to be altered in its passage through the arc.

"Finally as regards skill, not only do we mean the handling of the job by men of steady nerve, but the supervising skill to know that the weld is a good one, and the services of a welding engineer, not only to select the proper material for the work, but to attend to the weld designs from a previous knowledge by test and research."

NOTES ON INTERNATIONAL AFFAIRS

FROM NOVEMBER 23 TO DECEMBER 23

PREPARED BY PROFESSOR ALLAN WESTCOTT, U. S. NAVAL ACADEMY

GERMANY AND THE ALLIED POWERS

AMERICANS ON FINANCE COMMISSIONS.—On November 30 the Reparation Commission decided to appoint two committees of experts, one to investigate ways and means of balancing the German budget and stabilizing German currency, the second to seek an evaluation of German wealth abroad and means of getting it back to Germany. In this action the British acquiesced to the French plan for a strictly limited investigation which should leave untouched the questions of the amount of reparations and the legality of the Ruhr occupation.

The United States Government in a statement issued on December 11 declared that while the government was not in position to be officially represented on these commissions it would favor acceptance by American experts of an invitation extended directly by the Reparation Commission to act in a wholly unofficial capacity.

Accordingly on December 21 the commission formally decided to extend invitations to General Charles G. Dawes, Director of the U. S. Budget, and to Owen D. Young, Chairman of the Board of Directors of the General Electric Company, to serve on the first committee, the former as chairman. Both signified their willingness to serve. It was expected that another American would be appointed for the second committee. France, Great Britain, Italy, and Belgium will be represented in the expert commissions by two members each.

GERMAN REQUEST FOR FOOD CREDITS.—Early in December the German government requested permission from the Reparation Commission to borrow $70,000,000 in America to purchase food stuffs, the loan to take priority over reparations. The Commission decided on December 21 to refer the request to their Governments, unanimous consent being necessary. France indicated disapproval of the loan on the ground that there was abundant German wealth abroad to finance the purchase, as indicated by purchases of cotton and copper, and that the German wheat crop was the largest in thirty-five years and would be sufficient if properly distributed.

AGREEMENT FOR CONFERENCES ON RUHR SITUATION.—The new Marx Government in Germany, in view of the abandonment of passive resistance in the Ruhr, approached France and Belgium with a request for direct discussion of the Ruhr situation. Both the Allied nations replied favorably, stipulating, however, that the question of reparations should remain in the hands of the Reparation Commission, and that the discussion should be confined to plans for a more permanent *modus vivendi* in the occupied regions.

In the meantime German industrial leaders in the Ruhr had entered into direct six-month agreements with France for renewal of industrial operations. The coal magnates signed an agreement on November 23 with main points as follows:

(1) The mines represented by the German delegates will pay as the tax due for the period of January 1 to November 1 the sum of $15,000,000, or 279,000,000 French francs at today's rate of exchange.
(2) In future they will pay a tax of ten francs per ton on coal sold.
(3) They will deliver free to the powers of the Entente eighteen per cent of their net production.
(4) Stocks accumulated in the Ruhr on October 1 become the property of the Allied authorities.
(5) The system of export licenses remains in force. Accumulated stocks of steel and iron products can be released only against payment of taxes due and can be exported only in quantities equivalent to the average exports of 1922.
(6) Deliveries of by-products, sulphate of ammonia, benzol, tar, creosote, et cetera will be subject to a special agreement.
The agreement is for a period of six months, until April 15, 1924.

MARX FOLLOWS STRESEMANN AS CHANCELLOR.—The Stresemann Cabinet in Germany fell on November 23 after an adverse vote of 230 to 155 in the Reichstag. Its fall had for some time been expected in view of increased opposition on the part of both Nationalists and Radicals. To avoid the difficulties of a new election, President Ebert was forced to seek a leader for another minority coalition government. After seven days and the failure of four leaders, a government was finally organized by Dr. Wilhelm Marx, leader of the Catholic or Center Party in the Reichstag and a lawyer from Cologne. Stresemann took the Ministry of Foreign Affairs and the other members of the cabinet were chosen from the Center, German People, and Democratic Parties, but dependent for a majority on the support of the Social Democrats. Commenting on Stresemann's fall the *London Times* of November 24 said:

Stresemann has made a gallant effort and has failed because, having received no response and no real support from without, he has lost his purchase on the growing confusion of parties, the growing anarchy within. He turned to the Reichstag, and this appeal was an act of desperation. The Reichstag in present circumstances is a mere form and a fiction. There was nothing but this dying fiction to which the chief administrator of a State in such a condition could possibly appeal. Anarchy, through the shadowy Reichstag, has recorded its verdict.
What will happen now is an almost inscrutable problem. For Strese-

mann, President Ebert, and their associates it is a very serious problem; for all the world the plain fact is that Germany is breaking up. This fact must be realized now as the most important event in contemporary Europe, with the great tribulation of Russia in the background.

Germany is breaking up because one highly important area, that comprising the Ruhr and the Rhineland, has been torn from her, and as far as can be perceived will remain separated from the main body of Germany for at least a generation. It may be that during the next month or two the separation of the Rhineland and the Ruhr from Germany will assume some tentative political form.

HUNGARY

LOAN ORGANIZED BY LEAGUE OF NATIONS.—London, November 29.—Details of the proposed loan to Hungary, intended as part of the reconstruction measures for that country which the League of Nations has under way, have been worked out by the committee of the League which has been meeting here and which, it was announced yesterday, had agreed upon a scheme to be submitted to the League Council next month.

It is expected by means of decreased expenditure and a system of control that the budget can be balanced in two and one-half years, with the assistance of a loan of about 250,000,000 gold crowns.

Unlike the loan for Austria, no guarantees from foreign Governments will be required. The revenues from the customs, tobacco and salt monopolies and the sugar tax may be made available, with the additional security of further assigned revenues if they are required.—*New York Times*, 30 November, 1923.

RUSSIA

UNITED STATES AGAIN DENIES RECOGNITION.—Following President Coolidge's message to congress, which was interpreted as favorable to renewal of relations with Russia, Foreign Minister Tchitcherin of the Soviet Government made a direct proposal for conferences on the subject. Secretary Hughes replied indirectly through the U. S. Consul at Riga by a blunt message to the effect that Russia should first take steps showing her willingness to conform to international law in respecting the rights of foreigners and to refrain from political agitation in the United States. The State Department made public a document, vouched for by the Department of Justice, purporting to be instructions from the Communist International to the Workers' Party in America to prepare a revolution in the United States. Secretary Hughes insisted upon the practical identity of the International and the Soviet Government.

Tchitcherin subsequently denied the authenticity of the evidence published. In the U. S. Senate, Senators Borah and Norris criticized the action of the Secretary of State and demanded an inquiry into the question of Soviet propaganda. Secretary Lodge promised an investigation by the Foreign Relations Committee.

RECOGNITION EXPECTED FROM GREAT BRITAIN.—Newspaper statements in England indicated the prospect of recognition of Russia by Great Britain and reopening of full trade relations after the fall of the Baldwin

Ministry. Russia, it was reported, would admit liability for the pre-war debt to England but would ask compensation for Allied support to the White forces after the Revolution. After the adjustment of these claims there would remain a considerable sum due to British bond holders, but little prospect of resumption of payments.

Poland on December 20 issued a statement recognizing *de jure* the Soviet Government and the constitution of July 6 creating a Union of Soviet Republics, and agreed to renewal of diplomatic relations.

ITALY AND THE MEDITERRANEAN

ITALO-SPANISH ENTENTE.—The visit of the Spanish sovereigns to Italy at the close of November, preceded by the visit of the Spanish dictator General Primo Rivera, resulted in a drawing together of the two Latin powers in their policies relating to the Mediterranean and northern Africa, suggesting the possibility of co-operation strong enough to hamper either French or British policies in the Mediterranean region. The French *Matin*, discussing the effect of such an entente upon the safety of French communications with northern Africa, drew up a table showing the decided superiority of Spanish and Italian naval forces combined over those of France.

TANGIER AGREEMENT SIGNED IN PARIS.—Paris, December 18 (Associated Press).—The agreement between the powers for the future status of Tangier was signed at the Foreign Office this afternoon by the French, British and Spanish delegates. Prior to the ceremony the Spanish representative announced that he would act with the reservation that his signature be subject to the approval of his Government.

The plan maintains the open door at the port and provides for the protection of the interests of the foreign residents through an international assembly in which the United States will be represented. The capitulations are abolished and replaced by a mixed tribunal composed of French, Spanish and British magistrates, which will apply the codes and rules of the French and Spanish zones in Morocco.

In signing with a reservation the Spanish delegate stated that he agreed to the text only as a suggestion to his Government. In fact, the French and British Governments must also approve the project, which will then be submitted to all the signers of the Algeciras Treaty with the exception of Germany and Austria.

The approval of the French and British Governments is virtually certain, their delegates having come to a complete agreement, but the decision of the Spanish Government is doubtful in view of the rejection of the Spanish claims to greater influence in the administration of Tangier and compensation elsewhere in Morocco.

The Sultan will be represented in Tangier by a "Mendoub," who will be charged with the administration of the native population and will have powers of expulsion.

The Government of Tangier, except in so far as the administration of the native population is concerned, will be under a Committee of Control and an International Legislative Assembly. The Committee of Control will consist of eight consular officers of the powers which signed the Algeciras agreement. It will be their duty to veto any legislation which violates the Tangier statute.

The International Assembly will consist of twenty-six members. Of the European members, four will be French, four Spanish and three British, the other signatories of the Algeciras agreement being also represented. This assembly will have complete legislative authority over the native and European population. The native population will be represented by six Mussulmans and three Jews. The Mendoub will be ex-officio President of the Assembly and will be assisted by three vice-presidents of French, British and Spanish nationality. The International Assembly will nominate all administrative officers. For an initial period of six years the administrator and his two assistants will, however, be nominated by the three Governments. In view of the preponderance of French interests, it has been decided that the administrator shall be French. His two assistants will be British and Spanish. The commander of the gendarmerie will be a Belgian.

GREEK KING EXPELLED; REPUBLIC PLANNED.—The elections for a constituent assembly held in Greece on December 16 resulted in the formation of a body composed almost entirely of Moderate Venizelists and Republican Venizelists, the former claiming 224 Deputies and the Republicans 178 of the total of 402 seats. Leaders of the Monarchist and Anti-Venizelist parties requested their followers to refrain from voting.

On December 18 Colonel Plastiras, head of the Revolutionary Committee which has held control since the revolution of September, 1922, presented to the Gonatas Cabinet a resolution in behalf of Army and Navy officers condemning the Glueckberg dynasty, blaming it for the disasters of Greece in and after the World War, and demanding the forfeiture of the crown by King George. The Cabinet decided to request the King to leave the country, pending consideration by the new Assembly of the question whether Greece should remain a monarchy or become a republic. King George accordingly sailed for Roumania on December 19. The Premier refused to turn over the government at once to the Republicans, but announced that his Cabinet would hold office until the new Assembly convened in January.

GREAT BRITAIN

CONSERVATIVES LOSE ON PROTECTION ISSUE.—The British Parliamentary elections held on December 6, and contested primarily on the issue of the proposed Conservative policy of limited protection and preference to products of British dominions, resulted in a reduction of the Conservative majority in Parliament by about 100 votes, as follows:

Conservatives	257
Labor	192
Liberal	158
Independents	8
Total	615

The Baldwin Government decided to remain in power until the meeting of Parliament on January 10. In the meantime there was discussion

of the possibility of a Liberal-Conservative coalition to prevent a Socialist-Labor government; or on the other hand of coalition between Labor and Liberals.

UNITED STATES AND LATIN AMERICA

SECRETARY HUGHES STATES FOREIGN POLICY.—In an address to the American Academy of Political and Social Science in Philadelphia on November 30, Secretary Hughes made a comprehensive and important statement of American foreign policies.

In reference to the Monroe Doctrine, he pointed out that its two main points had been modified in later application as follows: (1) The original declaration against interference in American affairs by European nations has been extended to include all non-American powers; and (2) the declaration against further colonization has been extended to oppose further acquisition of territory by any means. He added that in our relations with other American states we had developed the following positive policies which might be regarded as supplementary and in harmony with the Monroe Doctrine:

(1) Recognition of the equality of the American republics and their equal rights under the law of nations, which as defined by the American Institute of International law include the right to exist and protect their existence and the right to exercise exclusive jurisdiction within their territory, with the corresponding duty to observe these rights in relations with other nations.

(2) A policy of non-aggression and of opposition to aggression by any Latin-American republic upon another.

(3) Opposition to offenses on the part of any state against the rights of citizens of another, such as confiscation of property.

(4) Promotion of stability by international conferences, agreements, etc.

(5) Promotion of settlement of disputes by arbitration and by extending our good offices as mediator.

(6) Encouragement of treaties for limitation of armament and of international action for protection of health, improving means of communication, etc.

(7) In commercial matters, most-favored-nation treatment in customs, with no special preferences.

(8) A policy of special interest with regard to Cuba and the protection of the Panama Canal, in view of which disturbances in the Caribbean region are of special concern to the United States.

Our policies regarding Europe and the Far East the Secretary summarized as follows:

"Generally, our policies toward Europe may thus be summarized: We are still opposed to alliances. We refuse to commit ourselves in advance with respect to the employment of the power of the United States in unknown contingencies. We reserve our judgment to act upon occasion as our sense of duty permits. We are opposed to discriminations against

our nationals. We ask fair and equal opportunities in mandated territories, as they were acquired by the Allies through our aid. We desire to co-operate according to our historic policy in the peaceful settlement of international disputes which embraces the policy of judicial settlement of such questions as are justiciable. It is our purpose to co-operate in those varied humanitarian efforts which aim to minimize or prevent those evils which can be met adequately only by community of action.

"In short, our co-operation as an independent State in the furtherance of the aims of peace and justice has always been and still is a distinctive feature of our policy."

So far as the Pacific and Far East were concerned, Mr. Hughes said, the United States had developed "the policies of (1) the open door, (2) the maintenance of the integrity of China, (3) co-operation with other powers in the declaration of common principles, (4) co-operation with other powers by conference and consultation in the interests of peace, (5) limitation of naval armament and (6) the limitation of fortifications and naval bases." He declared all these, also, were entirely consistent with the policy of Monroe.

Opposition to General Wood in Philippines.—By Richard V. Oulahan.—Manila, December 15.—The arrival of the advance guard of the Filipino Independence Delegation in Washington is expected here to bring forcibly to the attention of the American people and Congress the acute situation which has come to exist in the relations between the Philippine Legislature and the supreme authority in the islands represented by Governor General Wood.

While the outstanding aim of the delegation is the attainment of complete independence, it doesn't take long for a newcomer to the islands to reach the conviction that the more immediate desire is to force General Wood out of office in the hope of obtaining the restoration of that relationship between the Legislature and the representative of the soverign authority of the United States which existed under Francis Burton Harrison as Governor General.

That relationship amounted practically to the exercise of a mere nominal authority by the United States in the islands, with Filipino officials and a Filipino Legislature controlling the Government functions. The basis for this state of affairs still exists with complete Filipino domination of the Legislature and an almost complete Filipino personnel in the executive offices. The difference between the present conditions and that prevailing under Governor General Harrison lies in the absence of parliamentary participation in executive Government, because General Wood is exercising authority which he maintains is vested in him by virtue of acts of Congress.

Parliamentary participation in the executive Government resulted from an order issued by Governor General Harrison appointing a Council of State consisting of high Government department officials, the President of the Senate and the Speaker of the House of Representatives. Parliamentary representation in the executive Government ceased to exist when all the members resigned. The Council of State still continues, but without the participation of the President of the Senate and the Speaker of the House.

A vital impassé has been reached in the relations between General Wood and the Legislature. The Legislature is controlled by a coalition of Nationalist and Collectivist Parties, now engaged in conducting a policy of partial non-co-operation with the Governor General, which may produce a complete boycott of his Administration in so far as legislation is concerned.—New York *Times*, 16 December, 1923.

HUERTA LEADS MEXICAN REVOLT.—In December a formidable revolutionary movement developed in Mexico, headed by President Obregon's former ally and Treasury Minister De La Huerta. General Sanchez, in command of forces in Vera Cruz province, proclaimed his support of the Huertista movement, and a provisional government was established at Vera Cruz. The rebel forces occupying positions along the railway lines leading to Mexico City were attacked by strong government troops under President Obregon's leadership.

Trouble began with President Obregon's announcement on September 1 of his support of General Calles, Minister of the Interior, as his successor to the presidency. Calles stood for a strongly communistic policy, extending common ownership not only to mines and farm land but to other property as well. This policy was objectionable to the majority of the Cooperatista party, who expelled Calles and chose Huerta as their leader. Huerta resigned as Minister of Finance under Obregon, became candidate for president, and was then charged by his successor in the Treasury, Pani, with maladministration. The partisan conflict led rapidly to open warfare.

MISCELLANEOUS

FUTURE DISTRIBUTION OF WHITE RACE.—In an article in the *Geographical Review*, summarized in *Our World* for December, Professor Griffith Taylor of Australia made interesting prophecies regarding the future distribution of the white race over the world. He determined the desirability of various regions of the world on the basis of four factors: (1) *temperature*, which he rated twice as important as (2) *rainfall*; (3) *coal supply*, which he rated half as important as rainfall and twice as important as (4) *location*, or accessibility to the sea.

On the basis of these factors, and excluding parts of Asia and Africa as already pre-exempted by the yellow, brown, and black races, he "hazarded the estimate" that when populations throughout the world shall have reached the present density of Europe, or about 100 to the square mile, the white race will be located in the following chief regions:

	Population	*Per cent*
North American regions	702,000,000	52
European regions	386,000,000	29
South American regions	115,000,000	8.5
South African regions	82,000,000	6
Australian regions	62,000,000	4.5
Total	1,347,000,000	100.0

It will be seen that, according to this estimate, North America is destined to contain slightly more than half of the white population of the world.

REVIEW OF BOOKS

LA GUERRE DES CROISEURS. Du 4 Aout, 1914, à la Bataille des Falkland. Vol. II (Du 1er Octobre au 8 Decembre, 1914). By P. Chack, Capitaine de Frégate. Published under the direction of the Historical Service of the French Navy General Staff. Paris, 1923.

The first volume of this excellent work, covering the history of cruiser warfare from the outbreak of the World War to October 1, was fully reviewed by Admiral Gleaves in the Institute PROCEEDINGS for April, 1923. This second volume, with a separate volume of charts and maps, carries the story from October 1 to December 8 and the destruction of Admiral von Spee's squadron at the Falkland Islands. A third volume is planned to cover the work of German cruisers still abroad thereafter, of the later isolated raiders, and of long-range submarines.

In this volume the campaign against Admiral von Spee's squadron naturally occupies chief attention. The British measures to intercept the squadron after its victory at Coronel are spoken of as "a model of grand strategy, the study of which is productive of valuable lessons"; and indeed the phrase regarding valuable lessons holds true of this entire campaign. In the Admiralty's preoccupation with the *Karlsruhe,* and its decision to keep squadrons on each side of Magellan—each too small—the author accounts for Cradock's fate. Of von Spee's strategy upon his entry into the Atlantic, of the orders sent him to attempt a return to Germany, and of his fatal decision to go to the Falklands, Captain Chack remarks that had his squadron dispersed for commerce warfare on the Atlantic trade routes, it would in all probability have forced a weakening of the British Grand Fleet, so that the North Sea might have become the theater of a battle on more favorable terms for Germany. Or if the Grand Fleet had held to its concentration, the German cruisers would have created a paralysis of traffic more serious than at the outbreak of the war.

Of especial interest also is the author's study of the cruises of the *Emden* and *Karlsruhe,* and the methods of their respective commanders, Müller and Kohler, "both equally skilful, bold, and enterprising," but the former "marvelously combining moral effect with material injury, while his rival, by keeping his movements and accomplishments too long secret, preserved his own safety but neglected the effect of panic consequent upon the frequent arrival of bad news in allied ports. Both were great corsairs and both inflicted heavy losses on British trade, but Kohler was only a

terrible destroyer of ships, whereas Müller was also a formidable disturber of commerce."

Possibly for the average naval student these volumes, like the British Official Naval History, may be over-detailed. Such monumental records must be written for each nation; but what is needed now in English is a more concise treatment, enabling the reader to see each campaign as a whole, and at the same time dwelling at greater length on the lessons and questions of policy involved.

Captain Chack has drawn not only upon British printed and documentary sources, but also upon all French official documents, upon a French translation of Japanese reports of naval operations, and upon German printed sources such as Aust's story of the *Karlsruhe,* Brauer on the *Prinz Eitel Friedrich,* Mücke on the *Emden,* Lüdecke on the *Dresden,* and especially Captain E. Raeder's German Official History of *Der Kreuzerkrieg in den Auslandischen Gewässern* (Vol. I). Although the use of these sources insures a greater degree of fullness and accuracy, the works available in English, such as the British official history, will still perhaps be sufficient for any save the most thorough historical research.

A. W.

SYNOPSIS OF APPLICABLE MATHEMATICS WITH TABLES, by L. Silberstein, Ph.D., published by D. Van Nostrand Co., New York, 1923. Price $4.50, 250 pages.

The First Part, sixty-seven pages, of this book is comprised of common tables—logarithms of numbers, trigonometric functions, etc. The Second Part, the remainder of the book, is a collection of formulæ, definitions, theorems and tables of important special functions. Algebra and analysis are followed by geometry, given a larger proportion of space, and finally a few pages are devoted to vector analysis, quaternions and tensor calculus. There are tables of hyperbolic, elliptic, Bessel, zonal harmonic, gamma and error functions, Fresnel integrals, Bernoulli numbers, roots of certain transcendental equations, etc.

The matter is so condensed that the elementary student will have difficulty in reading the book, but the mathematician and physicist will find this compact collection of formulæ and special tables of great convenience and value as a handy reference book. The worth of the book could be greatly increased by omitting the tables of the First Part and the very elementary formulæ, and by using this space to include references to more complete treatises and the proposed Third Part, mentioned in the preface, on physical formulæ, laws and fundamentals of theory.

J. A. B.

FUNDAMENTALS OF RADIO, James L. Thomas, A.B. D. Van Nostrand Company, New York, 1923. $1.50.

A book of 200 pages "written to give the elementary theory upon which all sets operate." While largely theoretical, constants of certain simple transmitting and receiving circuits are included. An elementary knowledge of electricity and arithmetic is assumed.

An outstanding point of merit in this book is found in the treatment of a "Review of Elementary Principles" in Chapter I.

Although a number of errors may be found it is thought that these are not of such a nature as to interfere seriously with the object of the book.

G. D. R.

SECRETARY'S NOTES

Membership

Present Membership, 4336. Changes since last report: New Members, 13. Resignations, 218. Members Dropped, 108. Deaths, 7. Total Decrease, 320.

Membership and Subscriptions

There has been a certain amount of misunderstanding in some quarters regarding the change in subscription rates to the PROCEEDINGS, a notice of which has been published in these notes for a number of months. Membership in the Naval Institute, as heretofore, includes a subscription to the PROCEEDINGS, and the cost of membership (membership dues) remains unchanged. Regular membership is available only to officers of the Navy, Marine Corps, and civilian officers attached to the naval service. Associate membership is available only to officers in allied military services, or to persons in civilian life who are interested in "the advancement of professional, literary and scientific knowledge in the Navy," and only after application and election as such. Membership is entirely personal, and continues until resignation in writing has been received.

Subscription is available to any organization or person and is automatically discontinued at expiration. The subscription rate is $5.00 per year.

The special subscription rate of $3.50 per year is available only to members who wish to send gift subscriptions to their relatives or friends, in order to acquaint them with naval life and conditions. It is not available to societies, subscriptions for which must be at the regular rate.

1924 Dues

Dues for 1924 were payable on January 1st. Bills this year were sent out in December, enabling those who desired to resign to do so as of the first of the year, thus saving the sending of additional bills for one or two months of the new year. All who have not already

paid the current dues are urged to do so promptly, as the clerical work involved in sending out repeated bills is very great.

New Cover

With the January issue, the Naval Institute PROCEEDINGS appeared in a new cover, including correct representations of the Naval Academy seal and the Naval Institute seal. It is hoped that the new cover will be found more artistic as well as more appropriate.

Change in Rules in Prize Essay 1925

Prior to 1918, essays were specially submitted in competition for the "Naval Institute Prize," the names of the writers being in sealed envelopes which were not opened until after the prize winning essay had been chosen. The Board of Control feels that the change in method of awarding the prize made in 1918 has not brought about the results anticipated; and has lessened, rather than increased, the amount of competition. The Board has, therefore, decided to return to the former practice of awarding prizes, commencing this year. A notice covering the rules of the contest will be published as soon as practicable. This does not, of course, affect the "1924" Prize, the results for which will be announced in the next issue.

New Books

It is not always that a book prepared as a textbook is of value to the service at large. There are, however, instances where books are of as great value to officers in active service as to the midshipmen for whom they were prepared. There are now in preparation three books, each of which seems to fulfill that characteristic, and to have particular value to the officer who is preparing for his examination for promotion. These books are: "Leadership," "International Law" and "Notes on Naval Communication." The price of the first book has been fixed at $1.65, postage prepaid. The prices of the last two will be announced later. All of these books will be available in a few weeks. Those interested should make application without delay, in order that a sufficient number of copies may be printed to satisfy the demand.

Comment and Criticism

The Editor has been particularly gratified by the kindly comments made about the Naval Institute PROCEEDINGS, in letters received. Needless to say, such comments are an incentive to better effort, stimulate interest, and result in improved morale to all the Naval Institute staff. Comments and suggestions are always welcome, in order that the standard may be further improved, and that the PROCEEDINGS may be not only of interest to members, but helpful to the Service.

Errata

In the article "Farragut" by Rear Admiral Goodrich, published in the December issue, the following corrections should be made:

(1) Page 1978, the quotation "De l'audace, etc." should be attributed to Danton instead of Napoleon.

(2) Page 1984, date of Farragut's death should read "1870" instead of "1890."

Articles

The Institute desires articles of interest to all branches of the service, including the reserve force. Non-members as well as members may submit articles, and authors receive due compensation for articles published. Compact, well digested articles are more likely to be accepted for early publication. In accepting articles for publication, the Institute reserves the right to have such articles revised or rearranged, where necessary, in order to bring them up to the required standard of articles published in the PROCEEDINGS—the cost, if any, to be deducted from the compensation due the author.

Reprints of Articles

Twenty copies of reprints are furnished authors free of charge. Additional copies to the number desired will be furnished at author's expense, provided request is made before going to press.

Discussions

Discussion of articles published in the PROCEEDINGS is cordially invited. Discussions accepted for publication are paid for at approximately one-half the rate for original articles.

Book Reviews As soon as practicable after the publication of books on subjects of professional interest, the Institute aims to publish authoritative reviews of them.

Address of Members In the past, many errors have resulted from the habit of changing an officer's address as soon as his transfer orders are published in the papers. No change will be made in the future except upon receipt of the Navy Directory, or notification by the member concerned. Reliance upon the former method may, in extreme cases, mean a delay of almost four months.

To insure the prompt delivery of the PROCEEDINGS and other communications from the U. S. Naval Institute, it is essential that members and subscribers *notify the Secretary and Treasurer without delay of every change of address.* No responsibility can be accepted for failure to receive the PROCEEDINGS, where members fail to comply with this rule. Changes of address should reach the Institute by the 25th of the month, to be effective for the issue of the PROCEEDINGS of the following month.

Coupons for Applications For the convenience of members making application for membership or for subscription, or informing the Institute of changes of address, a number of blank forms will be found elsewhere in this issue. It is hoped that members will take full advantage of these in order to reduce clerical work of all concerned.

H. G. S. WALLACE,
Commander, U. S. Navy, Secretary and Treasurer.